CHEMICAL LIBRARY GENERAL LIBRARY MAY 18 1920 UNIVERSITY OF MICHIGAN

GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. CL. No. 2972.] LONDON, APRIL 27, 1920. [72nd Year. Price 8d.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C. 2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 London Wall.

TORBAY METER ENAMEL.

The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C. 3.
39/41, Old Hall St., LIVERPOOL.

C.48
ALUMINIUM ROOFING
Resists Sulphur Fumes
See Gas Leaflet by The
BRITISH ALUMINIUM Co., Ltd.,
109, Queen Victoria Street, London

GAS & CANNEL COAL CONTRACTORS.
WM. F. RUSSELL & SONS.
Telegrams for all Offices: "MONKLAND."
GLASGOW: 90, Mitchell Street;
NEWCASTLE: Exchange Buildings;
HULL: Exchange Buildings, Lowgate;
LIVERPOOL: 5, Castle St.; &
SWANSEA: Atlantic Buildings.

W. PARKINSON & CO.
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON & BIRMINGHAM.
(See Advertisement p. 182).

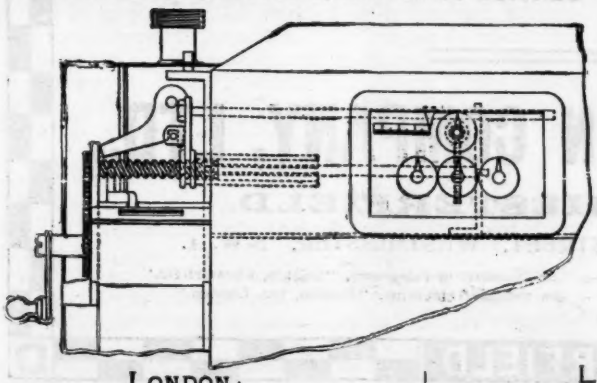
R. & W. HAWTHORN LESLIE & CO., LTD.
In Stock.
TANK LOCOMOTIVES
Always In Progress.
Locomotive & Marine Engineers & Shipbuilders,
NEWCASTLE-ON-TYNE.

INTERMITTENT VERTICALS.
Adopted all over the World.
Vertical Gas Retort Syndicate LTD.,
17, VICTORIA ST., WESTMINSTER, S.W.
Sole Agents for Australasia—
JAMES HURLL & CO. LTD., SYDNEY.

JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1840.

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

GEORGE GLOVER & CO., LTD.,
CHELSEA.



"THE STANDARD"
SLOT METER.
THE ACME OF SIMPLICITY.
NO SPRING in any part of the mechanism.
Can be fitted with STRONG BOX, if desired, or with "M & M" LOCK.

London:
RANELAGH WORKS,
ROYAL AVENUE, CHELSEA, S.W. 3.
TELEPHONE: 1140 Kensington.

Leeds:
9, DEWSBURY ROAD.
TELEPHONE: No. 26463.

Manchester:
GAYTHORN METER WORKS,
EASTON STREET.
TELEPHONE: No. 6898 City.

"FERRODOR" ELASTIC PAINT
For ALL Gas Plant and Steel Structures.
Does not blister or "chalk" off.
GRIFFITHS BROS. & CO. (LONDON), LTD.
HERMONDSEY, LONDON, S.E. 16.

MANCHESTER: 24, VICTORIA STREET, S.W. 1.
KENTISH TOWN, N.W.

J. & J. BRADDOCK

(Branch of Meters Limited),

GLOBE METER WORKS,

Telegrams: "Braddock, Oldham." Telephone 815.

OLDHAM,

AND

45 & 47, WESTMINSTER BRIDGE ROAD,

Telegrams: "Metrique, Lamb London." Telephone 2412 Hop.

LONDON, S.E. 1.

MANUFACTURERS OF HIGH-CLASS

GAS STATION METERS.

BRADDOCK'S

STATION GOVERNORS

AND

RETORT-HOUSE GOVERNORS.

IMPROVED

WET & DRY GAS METERS

OF BEST QUALITY.

BRADDOCK'S PATENT

"SLOT" METERS.

FULL PARTICULARS ON APPLICATION.

RETORT SETTINGS

WILSON'S (CONT-INT.) VERTICALS

HISLOP'S HORIZONTALS

RENEWALS &

NEW BENCHES

GAS-WORKS ERECTED COMPLETE.

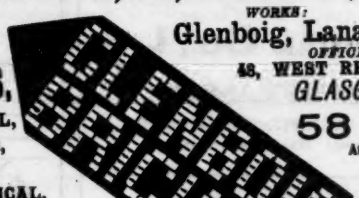
R. & G. HISLOP
Underwood House,
PAISLEY

THE GLENBOIG UNION FIRE-CLAY Co. Ltd.

WORKS: Glenboig, Lanarkshire.

OFFICES: 48, WEST REGENT ST., GLASGOW.

GAS-RETORTS, HORIZONTAL, INCLINED, and VERTICAL, to New Standard Specification.



58 FIRST AWARDS At International and Home Exhibitions, including Grand Prize at Brussels, 1910.

In every case the highest award given for Fire Clay Goods.

The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

B DONKIN D

DONKIN

for

DISTRICT SERVICE GOVERNORS

HIGH AND LOW PRESSURE SERVICE REGULATORS, METER REGULATORS,
STOVE AND LAMP REGULATORS, SERVICE CLAMPS AND FITTINGS.

THE BRYAN DONKIN COMPANY, LTD.,

Head Offices & Works, CHESTERFIELD.

LONDON OFFICE: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 5358 Victoria.

Chesterfield Telegrams, "Donkin, Chesterfield."
London Telegrams, "Donkin, Vic. London."

B CHESTERFIELD D

GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CL., No. 2972.] TUESDAY, APRIL 27, 1920. [72ND YEAR.

EDITORIAL NOTES.

The Bill.

A LITTLE impatience has been evinced in some quarters of the gas industry over the delay that has taken place in the introduction of the Bill in Parliament which is destined to pave the way to financial relief, and put gas manufacturing and trading affairs upon a new basis. We cannot say the delay so far is unfortunate in present parliamentary circumstances. There has been reorganization at the Board of Trade; and there has been change in the President, and changes in the heads of Departments. It is not an easy thing for an official succeeding a man, for instance, like Mr. Garnham Roper, to get into the stream of the affairs of a big industry such as that of gas supply, and obtain full knowledge of them at a minute's notice; nor is it possible for a man even of the intellectual calibre of Sir Robert Horne to become master of the details of the position immediately a predecessor like Sir Auckland Geddes steps from the presidential office. The gas industry has everything to gain by the new responsible heads at the Board of Trade being (before outer movement was made) fully versed in its present deplorable financial position, and its requirements to enable it to be of larger national service. For this reason, as well as for others—notably the congestion of business in Parliament at the opening part of the session—we are not sorry that there has been delay. The time, however, has come when movement is imperative—in view of the demands of labour, the outlook in regard to coal, and the cloud that rests over the industry in respect of meeting capital requirements, even at attractive rates of interest, and solely through the miserable condition to which the existing capital has been reduced through new-born economic conditions and old statutory limitations that are inconsistent the one with the other. Every day things are in these respects getting into a worse condition; and now the longer the delay, the nearer will a very fine industry—an industry occupying an immense place in the country's system of service and industrial operations—be brought to the very brink of financial disaster. We are therefore glad to hear that the period of unavoidable delay will very shortly now come to an end; and, if our information is correct, the Bill that will be introduced will, in one, embrace both the recommendations of the Beilby report as amended by agreement and the provision of the machinery to secure permanent financial revision. This is hearsay; but we believe it to be true. Of course, we do not anticipate that, when the text of the Bill is available, it will give the industry all it sincerely believes, and knows, it is entitled to. It is very rarely that desire is fully gratified, particularly in parliamentary matters. But this we do know, that the Board of Trade are anxious to make provision, endorsed by Parliament, that will render justice, and firmly restore definite and practical conditions to this long-suffering industry of ours.

Holidays and Pay in the Gas Industry.

THE newspaper placards have announced the probability of a strike in the gas industry, and of one of the great essentials of our public life—gas—being temporarily cut off from the public service. The extremists in the labour world who are not the gas workers' best friends or true leaders have been engaged in what appears to be to them the congenial task of villifying the industry, and of attempting to set public opinion against its responsible men. This is not fair. But hitting below the belt is regarded by them as a very proper accomplishment, and in it they certainly do excel. Fortunately for the industry, these are not the men with whom it has to deal. Between the real leaders and the men who conduct negotiations on behalf of the gas industry, good feeling prevails, although the industry knows well that there has been, and continues to be, an undue tightening of the screw, of which the industry is not in a position to stand more. There comes a time when the cost of production must exceed the intrinsic value of a commodity to the consumer. If then the industry concerned cannot bring relieving economies to its aid, so as to reduce the cost to the consumer, the consumer will naturally turn to alternative agents, if these are cheaper. Moreover, the gas industry is not one that can produce high profits; everything is against its doing so, even the gas statutes. Furthermore, the real leaders of the organized gas workers know full well that the administrators of the gas industry have been examples to other employers in their treatment of the men; and the men themselves know this. There is, if only on this account, something more due to the industry than a "stand-and-deliver policy." Besides, the men's leaders must be aware that the industry has not the wherewithal for satisfying the demands of such a policy, succeeding the strides in pay that have already been made.

The papers have had much to say during the past week as to a "deadlock" in the negotiations for annual holidays, and double pay for week-end work, overtime, and Bank Holidays. On these demands, the Federation of General Workers have served the Federation of Gas Employers with an application for an immediate increase of 10s. per week on existing wages, which were only quite recently placed at a higher level than ever before. It is contended that the cost of living has increased 16½ p.ct. since the last award. Regarding this last application, the Federation of Gas Employers have—and very properly—unanimously resolved that, having regard to the financial position of the industry, it is unable to pay the increase claimed. It is, indeed, easy enough to demonstrate that the industry cannot afford anything of the kind. A forty-four hour week is also demanded, in lieu of the present forty-seven hours. As to the annual holidays, the demand of the Federation of General Workers was for a fortnight and pay; and they wanted this to apply without any discrimination to large and small undertakings alike—that is to say, they desired the matter to be dealt with on a national basis. A good many undertakings in the position to give holidays do so, and with pay; but all gas undertakings are not in the same position. Therefore the Federation of Gas Employers made the very fair offer of an annual one-week holiday, with pay, in the case of undertakings with an output of over 50 million cubic feet. This was not regarded as being satisfactory; and so the Federation of General Workers tried to compromise by suggesting a twelve-day holiday a year with pay, excluding Christmas Day, Good Friday, and proclaimed national holidays—all to be paid for *pro ratâ*. Agreement could not be reached. Hence the deadlock, and the resolve to ask the Executives of the Unions involved to notify the Federation by to-morrow as to whether or not arrangements shall be made to take a strike ballot.

Of course, it is more likely than not that something may happen which will result in the re-opening of negotiations; but the actual position of the matter at present is no justification for some flaring newspaper placards announcing the likelihood of the country being without gas in a few days. Good sense is not dead on either side. If a strike ballot is decided upon, it will be very necessary for the facts to be fully and fairly placed before the men; for at the present time there are numbers of gas workers who are not aware

of the nature of the claims made on their behalf, nor did they know that such claims were going to be preferred. In fact, the first intimation that many of the men received that such a thing as a strike was being talked about over something not within their cognizance came through the newspapers. If the Unions agree to a strike ballot being taken, a uniform ballot-paper (it is stated) will be prepared; and then probably a fortnight would be required to take the ballot and ascertain the result. The "Daily Herald" thinks that a week will suffice, and that a gas strike will be here the first week in May. But we are hoping that the gas workers will show better sense than to authorize a strike under present conditions. However that may be, it is computed that approximately 100,000 men are involved; and that these are in the employ of 1293 undertakings, 154 of which are under municipal ownership, 110 urban district councils, 961 private companies, and 68 factories producing their own gas.

The feature that is most patent about the position is that the gas industry has not the financial ability to concede the heavy fresh demands. The matter in relation to it over which there should be the strongest resolution is that there shall not be any breaking away from the Federation of Gas Employers, nor any making of individual agreements in order to avert unpleasantness. The industry is face to face with a situation (which may or may not develop) that calls upon its units to act loyally and homogeneously, and not to jeopardize the position for the whole industry by individual action and cession.

The Civils Hear the Truth.

The "James Forrest" Lecture was delivered last Tuesday before the Institution of Civil Engineers by Sir Dugald Clerk, who took as his subject "Coal Conservation in the United Kingdom;" and the members had more light thrown on to an old subject, along the devious paths of which no doubt many of them have hitherto gone astray. But Sir Dugald has now placed, figuratively speaking, so many guide-posts for them to follow that they cannot again lose their way, and can test the truth of the information afforded by the guide-posts by ascertaining whether or not they lead to the destination of coal economy and conservation. Step by step those present at the meeting were taken through the proof that the Power Sub-Committee of the Coal Conservation Committee had gone singularly wrong in their conclusions as to what super-power stations would do in contributing to the conservation of coal, particularly if electricity trespassed on the heating field, and absorbed (as the Power Committee with ignorant vanity thought it might do) the business of the gas industry. Sir Dugald did not spare the Committee in the presence of competent judges. In this he was perfectly justified, for the Committee, by inflated statements and estimates, have done considerable mischief in misleading the Government and the, in these matters, great uninformed majority of the public. The beautiful computation of the Power Committee, which presented a chimerical saving of 55 million tons of coal a year through the adoption of the super-station scheme, was shown to be devoid of foundation, and only propped-up by fallacious reasoning. And when he came to deal with that piece of inanity as to electricity being substituted for gas for general heating purposes in the household, Sir Dugald had an equally easy task in proving that the hypothesis could never have any substantial materialization. On the facts that he submitted, "the super-stations will not justify their "existence. The Government scheme is wrong; and the "sweeping conclusions arrived at by the Coal Conservation "Committee are unjustifiable." Again, "in so far as elec- "tricity displaces gas for heating purposes, in so far would "the coal consumption of the country be increased." The position of the gas industry, in its modern aspects, has never before been placed before the Institution of Civil Engineers in so convincing a manner. The industry is progressing to higher efficiencies both in manufacture and utilization. Gas will shortly be produced and distributed at 75 p.ct. and used at 55 p.ct. thermal efficiency for general domestic purposes—that is to say, the ultimate efficiency from coal consumed at gas-works to heat utilized by the consumer is $0{\cdot}75 \times 0{\cdot}55 = 41$ p.ct. Then that is the way to real coal conservation; and the lecturer showed that the saving of coal to the country by the displacement of coal by gas would be immense. The importance of this in view of high coal prices and the conditions in the coal industry cannot be gainsaid. But let Sir Dugald not be misunderstood. He is a civil engineer and a scientist who is out for the truth, and has no desire for personal motives to have the Government or the country misled. Fuel economy and efficiency are what he seeks for; and his case is so strong that even now the Government would be well advised to have further inquiry to test its genuineness in relation to the Power Sub-Committee's report before proceeding with the second part of their electricity legislation. The lecture which we publish *in extenso* in this issue puts the case with a clarity and cogency which have not been excelled by Sir Dugald in any of his previous platform utterances on this subject. It goes deeper; and it carries us further. All that is wanted is there to convince an open-minded Government that the claims of the gas industry to parliamentary support and encouragement are as much in the national interests as its own.

Difficulties in Technical Determination.

There are times when it is exceedingly difficult even for men of high technical competence to determine in a particular matter the right course to pursue. This difficulty forces itself upon notice as one peruses the Presidential Address of Mr. W. W. Townsend to the Eastern Counties Gas Managers' Association. The position and variety of gas-production processes are to-day unique in the industry's technical history, and so are the demands for gas. If new works were being designed to-day, the gas engineer would find himself mentally battling with the virtues of vertical retorts and steaming, with water gas or complete gasification plant as a supplement, or, if the character of the most available coal insisted on being a factor, horizontal retorts, with one or other of the same supplements. The position of the man who requires to make extensions or renewals is equally disturbing. There are so many claimants, and so many factors to be considered—ranging from quality of coal, production of heat units, capital charges, depreciation and renewals, labour (a highly important matter to-day) and operating costs. As Mr. Townsend showed, it is in current circumstances impossible to dogmatize; but each case has to be considered in relation to its individual conditions before committing oneself to any particular line of action. The difficulty is greatest in a works of moderate capacity. In large works change can be gradual, and so ultimate determination can be based upon actual experience.

There will be no sudden revolution in this matter of gas production. These are not the days for the sacrificing of capital, or for unnecessary expenditure. Whether the product will justify the outlay under existing circumstances will depend, firstly and partly, on the condition of the present plant, and its capacity for meeting demand; and, secondly, whether the expenditure will produce, under the heat-unit basis of charging, a compensating profit through the increase of the B.Th.U. for sale. If it does so, then there will be no need to hesitate over the outlay. But the present time is an exceedingly good one for the change in the character of the gas for sale and the production of more B.Th.U. in gaseous form per ton of coal handled, because, owing to the war and the price of labour and materials, many works have not been able to do all they would have liked to have done in maintenance, renewals, and extensions. The leeway has to be made good; and the question comes whether, per heat unit of production, it will be cheaper to put in verticals or properly designed horizontals with steaming, water-gas plant, or complete gasification plant—the latter, if possible, with tar oils and ammonia recovery. The heat-unit basis of charging, as Mr. Townsend points out in his critical and excellent address as to the gas-production position, is bound to have a far-reaching effect on both the capital expenditure per heat unit of production and the future trend of plant invention. For the present, no one system is likely to reign supreme. The industry, however, is well on the highway (from which it will not depart) to a new order of things in relation to the manufacture of gas.

In our consideration of this matter, we must look to the future as well as the present. Mr. Townsend admits that his address was written, or the main parts of it were, some months ago. Changes come quickly in these times. We think that, in parts of his consideration of this matter, he is too much obsessed by the present value of residuals. Looking at pre-war secondary-product conditions, the rapid march of events during the war, and the prospects so far as they are capable of being judged from the position of to-day, we submit that determination in the choice of gas-producing

plant must be based upon intelligent anticipation as to the future in respect of secondary products, rather than present values. Present values weigh heavily with Mr. Townsend. "The extra value of residuals," he remarks, "also makes it "worth while to replace inefficient plant for the sake of the "savings effected." "In view of the present high prices of "coke, tar, and sulphate of ammonia, any process which "relies on gas only must show, by actual figures, that "the net cost per heat unit delivered to the consumer is "markedly lower than with other forms of plant." It is impossible to visualize the future of the secondary products markets with any pronounced or assured definition. The high prices of coke depend on high prices for coal. Gas coke is not a commodity that, through its own intrinsic virtues (as pre-war experiences warn us), will command a popular sale; and increasing gas production on the old lines would mean increased coke production. Tar commands high prices now. Bye-product coking plants are likely to continue their numerical progress; and there are processes being developed—low-temperature and two-stage carbonizing—and companies are being formed to prosecute business with the object of making money primarily out of liquid and ammonia products. There is no likelihood of the supply of tar being in the future unequal to the demand. And imported bitumen promises tar its competition for road purposes. As to ammonia, there are the synthetic processes; and big chemical firms are in the running in this matter. Substantial companies are looking to enlarge ammonia production from new coal-carbonizing processes. What will be the result of all this? What will be the result on our export trade of developments on similar lines in other countries? There seems to us to be only one answer; and that is that the percentage of the cost of coal derived from secondary products is more likely to descend than ascend—that is to say, when we reach our new normal conditions. Perhaps it is necessary to repeat what we have said before in this connection. We are not pessimistic; but it is only commonsense to look forward, and take account of possibilities in making present determination. We do not anticipate any sudden slump in the values of secondary products. Evolution will come steadily; but, looking to the future, we are not inclined to grant that present values of bye-products should have any dominating place in shaping choice as to gas-production processes. From these values a liberal discount should for safety be made.

In dealing with complete gasification and low-grade gas, the President, it will be remarked, sees no reason why ordinary carburetted water-gas plant should not be modified so as to be capable of complete gasification. In speaking of low-grade gas, Mr. Townsend says we must be sure it will provide B.Th.U. at a lower net cost delivered than is possible by the old practices, and that it is generally suitable for distribution not only for water boiling, but for use in geysers and circulators, and for the other purposes for which gas is generally employed. What does he mean by "low-grade" gas? In looking for a definition in the address, a clue is found which indicates that he is not far removed from some of the advanced ideas in this matter. His gas would be a mixed one of a much lower value than 500 or 475 B.Th.U. He is looking for an alternative plant which would produce a gas somewhat richer than blue water gas, while at the same time giving a good yield of sulphate of ammonia and tar oils. This is the direction in which he expects developments to occur. Plant of this type, he remarks, "giving a gas of 375 to 400 B.Th.U. "gross," used as an adjunct to coal-gas plant, would have a considerable effect on the conservation of coal, and would not displace altogether the production of coke. He adds that it may be that in course of time the whole of the gas supplied may be made by some method of the kind; but such a radical alteration would take years to effect. This shows the open, receptive mind of the President, and other parts of the address the analytical and discriminating mind, which prefers in matters of such importance as a change in manufacturing operations to proceed with discretion. But discretion makes the President none the less a progressive.

The Budget and the Profits Tax.

Several of the proposals contained in the Budget came as a surprise to most men; and there are components in the scheme of the Chancellor of the Exchequer for raising money to which almost every individual feels that he has good and sufficient ground for taking exception. But the fact has to be accepted that money must be obtained from somewhere to enable the country to meet its heavy obligations, and to make a beginning in reducing its monumental indebtedness. But it is highly questionable whether the Chancellor has not gone somewhat astray in respect of the fresh burdens he is proposing to put upon industry and trade. Even the increased cost of postage, telegrams, and telephones helps to make the conditions of business more onerous; but these things cannot be avoided. Postal, telegraph, and telephone services must be self-supporting. The increase, too, in stamp duties will not facilitate the distribution of, and transactions in, capital; and new enterprise will feel the increased stamp duty on capital from 5s. to 20s. p.ct. These are cases in which the increase of duty may have such a deterrent effect that the ultimate yield will be less under the higher duties than under the lower ones.

Increasing the burdens of industry by fresh and heavier taxation is not the way to raise production or to stimulate demand, and promote prosperity. There are the excess profits. Their reduction last year Mr. Chamberlain now considers was a mistake. He has seen no result in the lowering of the prices of commodities. Speaking for the engineering and manufacturing industries identified with the gas industry, we are not in the least surprised at this, inasmuch as their costs of materials and labour have made further flights since the percentage of excess profits was reduced. However, excess profits are now to make a 60 p.ct. contribution to the exchequer instead of 40 p.ct. Then there is the corporation profits tax of 5 p.ct. This new impost is described as applying to the profits of concerns with limited liability engaged in trade or transactions of a similar character. No tax is to be charged upon the first £500 of profits; and any excess profits duty payable will be treated as a working expense in arriving at the profits chargeable with the new tax. The assurance is given that in no case will the amount of duty payable exceed 2s. in the pound, or 10 p.ct., after interest on debentures and dividend on preference shares have been paid. This tax, it is expected, will bring in 3 million pounds this year, and 35 millions in a full year.

A question that has aroused interest is as to whether statutory gas undertakings are included in the term "concerns "with limited liability." There is little question that limited liability gas companies will be roped-in; and in most cases their ability to pay is of the very lowest order. Taking the words of the Chancellor literally, the new tax would not apply to statutory concerns, any more than to individuals carrying on business. But experience warns us in such matters as this not to rely upon even the natural interpretation of words, if there is the slightest room for any doubt. Perhaps the National Gas Council will move in the matter of securing a definite pronouncement upon the subject, so as to avoid trouble hereafter. It would be grossly unfair to impose such a tax on undertakings operating under statutory limitations as to dividends and price, which is not the case in non-statutory joint-stock enterprise. If statutory companies are to be included, then statutory trading undertakings run by local authorities should also feel the incidence of the new tax. Otherwise the gas consumers in one area would have to provide the money for the 5 p.ct. tax, while the gas consumers in another area, the business being under different ownership, would not. But what would such a tax mean in the case of gas companies? Simply this, that paying the dividend authorized by Parliament, and providing for the other financial obligations, gas consumers would have to be deliberately charged an extra amount to provide for the payment of the 5 p.ct. to the Government. We cannot think Parliament would consent to be the authors of such a piece of grotesqueness as this. However, it will be as well to have, before it is too late, a definite pronouncement on the matter.

Technical Gas Officials and the New Organization.

There seems to be a vast amount of inappreciation in the gas profession as to the aims of the National Association of Technical Gas Officials, and the claim it has upon all gas engineers. Many gas engineers in good position think that is it only something that is required by poorly-paid technical gas men for the advancement of their own interests. This is not so. The interests of the profession are a matter of common concern. Apart from the question of those in well-paid positions joining the Association with the view to holding-out a strong helping hand to their professional colleagues less—many much less—fortunate than

themselves, there is the question of raising the status of the profession, by making it, through fair reward, attractive to well-educated young men. The profession must have its quality and position raised from the bottom if it is to rank equally with other professions in the country, which it does not do at present, through (we fear) the apathy and indifference of many men snugly circumstanced. Invitations are being made to all technical men to join the Association. Circular-letters have gone round, and a copy is reproduced in our "Correspondence" columns to-day. Association meetings are being addressed on the subject—the Eastern Counties Gas Managers' Association, for instance, last Wednesday. Dr. E. W. Smith put the matter forward on behalf of the new Association; and there was a free discussion in private, which resulted in many seeing the matter in a fresh light. From what we hear, there are some men who complain that the Association have not yet framed a cut-and-dried policy; and that the aims and objects so far as they have been made public are ill-shapen and loosely jointed. We are not in sympathy with these views. The Association are taking a perfectly sound course when they say that, the general aims and objects being known, the first thing is to get together a numerically strong organization, and, when this is done, for the Association to decide in more detail and definiteness upon the line of policy. Technical gas men in good positions are needed in the organization to advance the honour and interests of the profession. Raising salaries to an adequate level is only a means to the desirable larger end.

Insufficiency of Six Per Cent.

With the revision of their financial terms an urgent need, gas companies are interested in the question of how the new issues of county and municipal loans are faring. These loans have security behind them with which a commercial undertaking cannot compete; but, though 6 p.ct. interest is offered, all is not well with public subscription of the loans. The Hertfordshire County 6 p.ct. loan was issued at 98; but it is stated that the underwriters have been saddled with 84 p.ct. of the issue. The underwriters have had to take (so it was announced) 90 p.ct. of the London County Council 5¾ p.ct. loan. It is thought that subscriptions were materially affected by the rise of the Bank rate to 7 p.ct. The issue of £3,000,000 of 6 p.ct. Birmingham Corporation stock has done better—some 65 p.ct. having been taken up by the public, which, in comparison, is considered good.

Price of Coal Increase Foreshadowed.

Guesswork estimates of the increase which will be necessary in the price of coal, in view of the further advance in miners' wages, have been published; but they are without the sanction of the Coal Controller. The prophets have placed the figure at anything between 9s. and 15s. per ton. It is officially admitted than an advance is inevitable; that the amount is at yet problematical; and rumours are afloat that sections of the miners are already threatening to strike if the price of domestic coal goes up. Some of the miners are most irrational. They seem to think that expenditure can swell and swell at their command without income growing proportionately, so as to be able to meet it. The additional cost for labour at the mines from March 12 is approximately £33,000,000 a year. Profits on exported coals have been reduced; and less coal is now going out of the country. The reduction in the cost of bunker coal is equal to £24,000,000 per annum; and domestic coal is being sold at home at a loss. These considerations pieced together show why an increase in the price of coal is inevitable.

British Commercial Gas Association District Conferences.

Arrangements are being rapidly pushed forward for holding District Conferences of the British Commercial Gas Association to discuss mainly the questions of housing and smoke abatement. The first is to take place at Darlington next Friday, under the presidency of Councillor Charles F. Dixon (the Chairman of the Gas Committee), when there will be addresses given by Mr. F. W. Goodenough and Mrs. M. A. Cloudesley Brereton, and a lecture by Dr. C. W. Saleeby. A District Conference will also take place in Manchester on May 13; and other fixtures provisionally made by the Secretary (Mr. W. M. Mason) are Bath (Southern District) June 14 or 15, and Leamington (Midland District) May 14.

Mr. W. G. Cooke, A.R.I.B.A., Assoc. Inst. C.E., is to read a paper on the "Assessment of Engineering Undertakings" before the Society of Engineers at a meeting at Burlington House on Monday next, May 3.

PERSONAL.

Captain W. H. Topley, who has been appointed Assistant Secretary to the British Gas Light Company, Ltd., entered the Croydon Gas Company's service in 1902, and was Chief Clerk at the time of his resignation. In March, 1915, he was commissioned to the 12th London Regiment ("The Rangers"). In 1919, he relinquished his Commission, being unfit for general service owing to wounds, and was granted the retiring rank of Captain. Several gifts testified to the esteem of his colleagues, whose best wishes for a prosperous career he carries with him to his new appointment.

Mr. G. W. Grosvenor, D.L., J.P., on being re-elected Chairman for the ensuing year of the Kidderminster Gas Company, was presented by the Directors with a handsome silver salver, "in kindly appreciation of his services for fifty years as Director." Colonel Goodwin referred to the very pleasant relationship which had always existed between the Chairman and his colleagues on the Board, and mentioned that Mr. Grosvenor had been Chairman for eighteen years. Mr. Grosvenor, returning thanks, said that, though he had been a Director of the Gas Company so long, he had always tried to remember he was also a servant of the public.

OBITUARY.

Mr. John E. Fottrell, who has just died at his residence at Clonskeagh, Dublin, was for many years a Director of the Alliance and Dublin Consumers' Gas Company, and was also associated with other Dublin enterprises. He was present at the recent annual meeting of the Gas Company, where cordial reference was made to his great interest in the concern and his constant devotion in the work of the Board. A shrewd man of business, and courteous and kindly in all his dealings, Mr. Fottrell will be much missed by his colleagues, and by the staff and workers, in whose welfare he at all times interested himself.

The death occurred last Wednesday, at the age of 51 years, of Mr. John William Wallis, Joint Managing-Director with Mr. J. Wilfrid Drake of Messrs. Drakes Ltd., of Halifax. Mr. Wallis was articled at the works of Messrs. Robert Dempster and Sons, of Elland; and in 1891 he commenced work as head draughtsman to Messrs. Jonas Drake and Sons, Ltd., as the firm was styled at that time. In 1914 he joined the Board, and in the early part of 1919 became Joint Managing-Director. During the war Mr. Wallis did good work as Chairman of the Halifax Munitions Committee; and for five years he was President of the Halifax Branch of the Engineering Employers' Federation. His services in these connections were recognized by a handsome presentation made to him some two years ago.

The South Suburban Gas Company have lost a valued Director by the death on the 18th inst., at a nursing home, after an operation, of Sir John Boraston, Kt., J.P., of Beckenham, who had been a member of the Board since the early part of 1908. Born in 1851, he was a solicitor by profession; but throughout his life he devoted himself largely to politics—becoming Joint Principal Agent of the Unionist party. At the outbreak of the war in 1914, he became one of the Hon. Secretaries to the Parliamentary Recruiting Committee, and also took an active part in the work of the Parliamentary War Savings and National Services Committees. He was knighted in 1916. The funeral took place on Thursday, at St. Luke's, Bromley Common; the first part of the service being in St. Paul's Church, Beckenham. Among those who were present were Mr. Charles Hunt (the Chairman), and other Directors of the Company.

The death is announced of Dr. Rudolph Messel, F.R.S., which took place last Sunday week at the age of 72. Dr. Messel, together with the late Mr. Spenser Chapman, in 1874 founded the firm of Chapman, Messel, and Co.—now Spenser Chapman and Messel, Ltd., chemical manufacturers, of Silvertown. Until a severe illness which commenced in 1915 compelled him to retire from active business, Dr. Messel was Managing Director of the firm.

More British Don'ts.

In an editorial note headed "More British Don'ts," the New York "Gas Age" says: The British gas industry has a bone to pick with the Fuel Economy Committee of the British Association, and the English gas journals are unanimous in denouncing the suggestion of imposing more restrictions upon the industry. The Committee conferred with the President of the British Board of Trade regarding the proposed legislation regulating gas supply, and had considerable to say about gas standards. . . . We had been hoping we were now free from bogey-fighting legislation. In providing against possible dangers, authorities fail to see that they penalize perfectly safe operation, and impose a burden upon the provider of the service which defeats the very end of the regulation—satisfactory gas service at a reasonable price. Everyone knows that children who are met with a "Don't" at every turn are of less gratification to their parents than those who are instructed, encouraged, and assisted. Perhaps gas companies might surprise these paternal legislators as to how good they can be, if the numberless "Don'ts" were cut out and a little commonsense business judgment used in assisting them. Why not try it?

ELECTRICITY SUPPLY MEMORANDA.

The Amending Bill.

The new Electricity Bill, which is intended to bring into being the powers that the Government were forced to hold over from the electrical measure promoted last session, is prefaced by a Memorandum which states that "the Bill reproduces, subject to one or two small amendments, the provisions of last year's Bill, as passed by the House of Commons, which were struck out by the House of Lords." If one wanted to be critical, it could be said that the "Memorandum" itself might be the subject of amendment. "One or two small amendments." It is true that in the Bill there is no important change in principle; but the phrasing of the clauses has undergone considerable modifications. Then, too, as to the declaration that certain provisions were struck out by the Lords. As a matter of fact the withdrawal of the provisions was made by the Government when the Bill was in the Lords in order to save part of the Bill, and thus time in getting the Electricity Commissioners to work. However, the provisions of the new Bill are the controversial ones of the old; and we are looking for the display of some keen discussion, on the one hand, in defence of the action of the Government in this matter of electricity supply, and on the other in the effort to prevent the Government making a departure in the control of industrial life and individual action which can result in no good to the country, while it will offer much encouragement to the labour extremists. The opposition will come alike from within the electricity industry and from those who regard these matters from the wider point of view of what is the right course to pursue in the relations of the Legislature to industry.

The Clauses.

The first clauses refer to the constitution and general powers of District Electricity Boards. Under these, if it appears to the Electricity Commissioners that in any area the provisionally constituted electricity authority for the district will not give due and proper effect to the principal Act, the Commissioners may formulate a scheme for the district, and may establish a District Electricity Board for it. This clause confers big powers on the Electricity Commissioners, which powers those responsible for the existing undertakings do not like, because they provide all that is needed in the way of compulsion. If such Boards are appointed, they will possess very wide powers—powers in excess of those of a Joint Electricity Authority, which the undertakings are authorized to establish under the principal Act. These new clauses are not being pushed forward for nothing. That the Government are insisting on them shows that they have not any complete faith in the present owners throughout the country consistently doing all that the Government think they ought to do, and that the Government are of opinion they will leave undone many things which, according to their light and the advice tendered to them, they consider ought to be done. Then follow the clauses providing for the vesting of generating stations and main transmission lines in the Boards; and these powers it is seen may be applied to a Joint Electricity Authority by a scheme under the principal Act. The financial provisions as to payment for generating stations and main transmission lines succeed. Then there are the clauses defining what is the "standard" price to be paid for works in the case of local authorities and companies respectively. If it is considered that any injustice will be done to the present owners under these terms, then arbitration is to be arranged for. The obligation that stood in the old Bill as to the supply, by a District Electricity Board or Joint Electricity Authority to the existing owners of generating stations, of electricity to the amount that might have been generated at the station, and not at a greater cost, is reproduced; and there are quite a number of conditions attaching to this clause. Authority to make agreements for the working of generating stations, and power to authorized undertakers deprived of generating stations to require the rest of the undertaking to be purchased appear. Provisions relating to borrowing by Boards and Joint Electricity Authorities succeed, together with authorization as to the issue of stock. Authorized undertakers are to have power to afford financial assistance. Then comes the provision to empower the Electricity Commissioners to lend up to 25 million pounds. In this connection, we see that—

> Interest on electricity stock shall be charged on the electricity loans fund; and the Treasury may guarantee, in such manner, and on such terms as they think fit, the payment of such interest; and any sums required by the Treasury for fulfilling their guarantee under this section shall be charged on, and paid for out of, the consolidated fund of the United Kingdom, or the growing produce thereof, and any sums payable by the Commissioners to the Treasury as consideration for such guarantee as aforesaid shall be paid into the Exchequer.

A number of miscellaneous clauses appear, among them one providing for the prices to be charged by an Electricity Board or Joint Authority being fixed subject to the approval of the Electricity Commissioners.

> In addition to any provisions contained in any Special Act or Order limiting the prices to be charged by authorized undertakers in respect of the supply of electricity, the Electricity Commissioners may regulate such prices with a view to securing that the benefit of any reduction in the cost of electricity to the undertakers, or in the capital employed by them in their undertaking attributable to the provisions of the principal Act or of this Act, shall inure to consumers.

With certain modifications, the Act will apply to Scotland and Ireland. The present measure, it is proposed, shall be construed as one with the principal Act.

Production Stopped by Electric Breakdowns.

There have again been several breakdowns of electric generating plant just recently. We have not been making any particular record of these; but in one week's issues of the electrical papers there are noticed three breakdowns which had a very bad industrial effect. The trouble in an industrial area is not confined to the accident at the place of energy generation, but the effects spread to every factory dependent on electric motors, and those effects include the stoppage of production on the part of both machinery and men. One of the breakdowns was at Leeds. There a heavy short in a sub-station on April 7 caused a collapse of supply for over an hour in the afternoon. During that time several works in the area were deprived of power. On the same day at Bolton, owing to a mishap (this being the second recent failure), 75 p.ct. of the plant was put out of action. "Several" mills were compelled to close down temporarily. Through a sudden strike at the Southampton Electricity Works, on a recent Tuesday, the electric power was cut off, and many factories had to close down. As the result of a strike at Runcorn lately, the Mersey Power Company, who supply electricity to all the large chemical works and factories in the neighbourhood, had to cut down its output to the limits of the necessities of the public utility services. Works without their own generating plant suffered severely, and were compelled to stop the work of hundreds of men. Places of amusement had to alter their arrangements, and the Runcorn Transporter Bridge only rendered a half-hourly, instead of a ten-minute, service. Owners of factories will soon, if this sort of thing continues to happen, find out that there is some virtue and value in a private generating plant.

Death in the Bath.

It would be a very safe rule to keep electrical appliances out of the bath-room. From time to time, the bath-room is the scene of fatalities through the use of electrical appliances in them. A domestic servant died the other day in a bath-room at St. Anne's-on-Sea. Her mistress thought she had been absent a long time; and as no reply could be obtained from her, she burst open the door, only to find the girl unconscious in the water. As she lifted the girl's head she felt an electric shock, and discovered that an electric hair-drier was lying in the bath—the current being still on. There were burns on the forehead and on parts of the body. The voltage was the quite common one of 240. The "Electrical Review" comments on the case, and makes certain errors. It states there was no evidence that deceased received a shock at all; and the verdict was death by drowning. What, then, caused the burns? Which, too, was the verdict, "Death by drowning," or "Accidentally drowned while taking a bath, probably as a result of an attack of syncope, due to burning caused by an electric hair-drier?" However, our contemporary points out that the one spot in the household where the conditions are highly favourable to shock is the bath-room; and for the bath-room too much care cannot be exercised in the selection and installation of electrical apparatus. "The occupant of the bath is ideally situated to receive a fatal shock if contact is made with a faulty metal switch-cover or an electrical appliance which is in contact with the circuit."

Gas Displaces Electric Street Lamps.

Electrical people recently had a shock when they learned that the Chelmsford Town Council were finding gain in ending their business relations with the local suppliers of electricity for street lighting, and were going to revert to gas on modern lines. Of course, the electricals put this down to the fact that the Council had purchased the gas-works, which act does not indicate a feeling on their part that gas is by any means played-out. But the truth of the matter is that the Council were able to get more light into the streets for a lower price than was possible the electrical way. Again in Airdrie (N.B.), the arc lamps have been displaced by high-pressure gas-lamps, and the incandescent electric lights by incandescent gas ones. A report tells us that undoubtedly a great improvement is apparent in the main thoroughfares; and the better illumination of the streets is greatly appreciated by the townspeople. This reminds us of the statement of the Mayor of the City of Westminster (Alderman G. W. Tallents) last October [see "Journal," Nov. 4, p. 239] that Pall Mall is the best lighted London street—illuminated as it is by high-pressure gas-lamps.

Heating and Cooking in the New Dwellings.

A fortnight ago attention was drawn to some points in Mr. Leonard Milne's paper on the "Electrical Equipment of Artizan's Dwellings." There are two or three other features which are worth noticing. One might be excused for suggesting that it would be well to have an examination into the mental state of men who advocate the use of

electricity for heating, cooking, and hot-water supply in artizan houses. This does not apply to Mr. Milne, who is very guarded in what he has to say. He puts the position no stronger than that it is highly desirable that a supply of electricity should be available for all purposes. The expression of opinion on the part of an electrical man, that availability is highly desirable, does not denote any depth of belief on his part that such a course is highly practicable. Mr. Milne's feeling as to the "highly desirable" condition is accompanied by the philosophic view that the anticipated revenue should be sufficient to justify the expenditure. Cooking, warming, and hot-water supply by electrical means in the artizan's dwelling would quickly result, when cost and other correlative matters were experienced, in the flow of revenue from these quarters being completely cut-off; and the equipment in the workmen's houses would then constitute a white elephant of quite respectable size. These questions must be viewed practically, and not foolishly. Mr. Milne admits that as regards heating, the elimination of fires from the room where heat is constantly required cannot reasonably be anticipated. But in bedrooms where artificial heat is only required "in cases of sickness and on rare occasions" electric stoves are, in his opinion, eminently suitable. It is a very wise man who limits their use to "cases of sickness" and "rare occasions." By substituting, for chimneys and grates, efficient forms of ventilation in all rooms but living rooms would, Mr. Milne states, save £25 per house, and would further provide an additional 15 sq. ft. of floor space. Gas-fires will do all this and more (as the authorities have learnt from plans and estimates for houses) by leaving flues in the brickwork which would be ample to secure ventilation of ordinary rooms in artizan dwellings. We should like to know something as to the "efficient" forms of ventilation that Mr. Milne would advise in all rooms where electricity is used, and the cost of making the provision. As to cooking, he thinks it would pay electricity supply undertakings to quote preferential rates for cooking in artizan dwellings, since the range will be used chiefly for the mid-day dinner at or near the time of minimum day-time load on the station. There has been too much of this preferential business in connection with electricity concerns; and the result is seen, though prices for heating now range from 2d. to (say) 4d. per unit, in a plentiful crop of deficits. Poor artizan! To think of having to pay 2d. for 3420 B.Th.U.; and then, for the major part of his heating requirements in connection with cooking, to obtain an efficiency of only 40 to 45 p.ct., with the heating elements progressively declining from even this performance. As was mentioned a fortnight ago, when referring to the goods shown at the Building Exhibition, of the 1296 houses erected by H.M. Office of Works in the south-eastern part of London, 1286 use gas only, nine gas and electricity, and one electricity only.

Electric Water Heating for the Artizan.

We should like Mr. Milne to demonstrate to us that "a domestic hot-water supply may be obtained more cheaply electrically than in any other way." Though he says this, we are pleased to see his acknowledgment that "the price is still high for an artizan family." The artizan family must have hot water, and have it in the way that will show the most moderate cost, and rapidity in provision. That is not the electrical way. The view of Mr. Milne that gas-heated geysers are costly is not preventing them going into artizan dwellings; and the artizan is not a being bereft of all sense. Anyone who knows anything about water heating, and considers Mr. Milne's statements, will easily see the physical and economic disabilities under which water heating by electrical methods labours.

There are several electric water-heaters on the market for which an efficiency of 90 p.ct. or over is claimed when the apparatus is used to its full capacity over a period of twenty-four hours. It appears essential that some form of thermal storage be employed if electric heating of water is adopted. To give a convenient supply of bath water, 18 gallons of water at a temperature of 104° Fahr. should be available within ten minutes; and to provide this without thermal storage, even with a heater of 100 p.ct. efficiency, and assuming a temperature of 55° Fahr. for the inflowing cold water, would require over 15 KW. for ten minutes. With arrangements which would ensure that the water-heater load was off at times of peak load, a rate of ¾d. per unit or less should be quoted for this service. This works out at just over 6d. a day. The objections to thermal storage by means of the heated cast-iron block are the weight and bulkiness of the apparatus. The objection to thermal storage in the hot water itself is that either a large cistern is required for adequate storage, or that the water has to be stored at a high temperature, increasing the thermal losses, and, moreover, rendering the water unpotable and liable to deposit scale. Water at a boiling temperature should be available in small quantities, a somewhat larger quantity at about 130° Fahr., and a copious supply at 104° Fahr. For artizans' dwellings, the direction in which the final solution of the problem lies is to fit a small boiler in the parlour grate, to store tepid water at (say) 80° or 90° Fahr. in winter time, and to employ what may be called an electro-thermic booster to raise the tepid water to the required temperature.

In other words, the electrical remedy is to have two-stage heating of water in artizan dwellings. We need not worry much about the water heating business in such dwellings going to electricity. If it did, it would be about the surest way of finally disposing of this freakish system of heating water, which can be done better, cheaper, and quicker by other means. Stay, we had forgotten that some men are friendly disposed to the electric shaving-pot; but they find, in order to preserve its service, that it must be dealt with very exactly and tenderly.

SIXTY YEARS AGO.

[From the "Journal" for April, 1860.]

The Cubic Foot Measure.—We have heard so much about the Astronomer Royal's bottle, that there is some danger lest he should obtain the credit of being the inventor of the form of vessel contrived for the accurate measurement of a cubic foot. It is now upwards of four years ago when, in answer to the question, "What is a cubic foot of gas?" we drew attention to the ingenious instrument contrived by Mr. Alfred King, of Liverpool, and then used by him for some years as a cubic foot measure. We explained, at the time, its principle of construction; and a proof of the great care with which Mr. King prepared the instrument has recently been afforded by comparison with what is called the Astronomer Royal's cubic foot bottle.

It would have been opposed to the impractical regulations of the Circumlocution Office to have adopted so simple and effective a contrivance, invented by a private individual. Therefore, when required to deposit a standard cubic foot measure, they set their own officers in motion to invent and to construct an independent instrument. In pursuing that course, however, the plan that seems to have been adopted was to commence by taking Mr. King's instrument to pieces; and, having extracted the upper vessel, or cubic foot bottle, they made a duplicate of it, and deposited that copy, with due form at the Exchequer Office, as an original standard instrument. Having accomplished that feat, the remaining portion of Mr. King's instrument, the whole of which he called a "cubic foot measure," was treated as a separate vessel, and was also deposited at the Exchequer Office as the "gasholder" required to be provided by the third section of the Sale of Gas Act. Thus, after having divided Mr. King's cubic foot measure into two vessels, and given them separate names, the Circumlocution Office would have reposed from their labours, had it not been for the active exertions of the meter manufacturers, and others, who were determined, if possible, to prevent the object of the Act from being so frustrated. The *protégés* of the Circumlocution Office having been driven from their untenable position, were anxious to show how the cubic foot measure might be applied to graduate real gasholders by restoring the two instruments to their original connections—not, indeed, as constructed by Mr. King; for in his instrument the bottle is enclosed and protected by a metallic case, whereas in the prototype the bottle is completely exposed to injury.

Carborundum Lining for Gas-Retorts.

In a recent number of the "Journal für Gasbeleuchtung," Herr P. M. Grempe recommends the lining of gas-retorts with a water-paste consisting of 75 parts of carborundum and 25 parts of water glass, or 85 parts of carborundum and 15 of fireclay, well mixed and agitated. The deposit is allowed to stand for twenty-four hours, and the retort is then slowly heated. A thickness of 0·5 mm. is sufficient; so that about 1200 grammes of carborundum will be wanted per square metre of retort surface. These linings have given satisfaction in furnaces for coal, coke, and gas firing; while flaws in the retorts are repaired with the same mixtures. The suggestion is, of course, not new, says "Engineering;" carborundum-lined muffles having been used in the National Physical Laboratory for years. But the lining of large retorts is a different thing.

Labour-Saving Devices in Chemical Works formed the subject of discussion at the third conference of the Chemical Engineering group of the Society of Chemical Industry. The conference was held in the University, Edmund Street, Birmingham, on Friday; a number of short papers being submitted, dealing with various phases of the question. In one of these, Mr. H. Blyth, of Messrs. Strachan and Henshaw, drew attention to the extensive adoption of telpherage in gas-works for handling coke and other materials.

It is stated by "The Times" that the problem of establishing in this country the manufacture of ammonia synthetically, and thus providing a source, independent of supplies of saltpetre from Chili, of the nitrates that are essential for making high explosives as well as for fertilizing purposes, has been settled by the arrangement that a group of firms shall take over and work the uncompleted factory at Billingham-on-Tees. The erection of the factory was decided on by the Explosives Department of the Ministry of Munitions towards the end of 1917. It is understood that the negotiations are on the point of completion.

At a recent meeting of the Faraday Society, Sir Robert Hadfield (the President) pointed to the important part taken by the Society in 1916 and 1917, in starting the movement which led to the forming of the Nitrogen Products Committee of the Munitions Inventions Department. The occasion of the announcement was the receipt of a letter of thanks from Sir Graham Greene (Secretary of the Ministry of Munitions), acknowledging the help rendered by the Society and many members. The letter states that arrangements are now on the point of being concluded whereby the synthetic ammonia factory which had been partially erected is to be transformed into a commercial project on a very large scale; and many other fixation schemes are under consideration throughout the Empire.

THE FUEL RESEARCH BOARD AND GAS STANDARDS.

The report has just been issued for the years 1918 and 1919 of the Fuel Research Board of the Department of Scientific and Industrial Research. It is signed by Sir George Beilby, F.R.S. (the Director of Fuel Research), who has for his colleagues on the Board the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., Sir Richard Redmayne, K.C.B., and Sir Richard Threlfall, K.B.E., F.R.S. There are set forth the general considerations which led-up to the scheme of work proposed in the previous report, and to the establishment of a Fuel Research Station of a new type; and attention is drawn to the alteration in the general situation, owing to the greatly increased cost of coal. Speaking of the immediate importance of fuel economy, the Board say the action called for is the organization of fuel control by all large users of fuel. A substantial portion of the report is on the subject of "Gas Standards;" and this will be found below. The other part of the report reproduced in the present issue is the description of the Fuel Research Station at East Greenwich, and its functions. Further matters dealt with—which include heating efficiencies, air pollution, pulverized coal, peat inquiries, and alcohol as fuel—are held over for subsequent notice.

GAS STANDARDS.

In June, 1917, the Fuel Research Board were asked by the Board of Trade and the other departments concerned to advise as to the future policy in regard to gas standards. With the approval of the Privy Council Committee for Scientific and Industrial Research, the Board accepted this duty.

After consultation with the Board of Trade, a conference of leading representatives of the gas industry and of the larger bodies of consumers was held in July, 1917. At this conference the Board were informed of the general attitude of the producers and consumers on the subject; and the Director expressed the hope that an agreement would be reached which would be satisfactory, not only from the points of view of those more immediately interested, but also from the wider view of national economy and prosperity.

The representatives of the National Gas Council and the Institution of Gas Engineers gave an outline of a programme of research which was then in progress, which it was believed would throw useful light on some of the technical questions connected with the use of gas of varying composition and calorific value.

During the succeeding eighteen months the Board pursued its own investigations and inquiries; and, by the end of 1918, they were in a position to present to the Board of Trade a report in draft. With the concurrence of the Board of Trade, it was decided to hold another conference with the representatives who had attended the former conference, and to submit the draft report for discussion. Some of the proposals of the report were subjected to considerable criticism; and it was decided to hold it back till the more controversial points had been discussed less formally and in more detail with the individual representatives. As a result of these further conferences, substantial agreement was reached on the central proposal that gas should be bought and sold on a definite thermal basis, and that the provisions laid down, if efficiently carried out, would give to the gas undertakings a wider elasticity in the choice of raw materials and processes than they had hoped to gain, while the interests of the consumers would be more effectually safeguarded than they are at present. The report of the Board was put into final form and handed to the Board of Trade in January, 1919.

As discussions in the technical press indicated that some misunderstandings as to the meaning and effect of the recommendations still existed, a further general conference was held, at which many of these points were cleared-up, and the few which remained were held over for further conferences of a less formal character. Meantime the Board had before them the total heat recording calorimeter of Mr. Simmance, and decided to instal a specimen of this instrument at their headquarters in Great George Street, so that its performance could be watched and studied day by day; and, further, that it might be open to the inspection of gas engineers and others interested in its work when in regular commission. After the instrument was installed and in regular work, this fact was notified in the technical journals, and inspection was invited. This invitation was responded to very freely by a number of representative engineers and chemists—from the consumers' as well as the producers' side. The place which a recording calorimeter will occupy in the future relations between consumers and producers is dealt with more fully in the sequel, and is only referred to here as one of the steps in the general development of the position.

As the result of the negotiations held during the summer months of 1919, it was believed that a general agreement on all the points under discussion might now be reached, and that a supplementary minute embodying these changes could be presented by this Board to the Board of Trade. A general conference was therefore held on Oct. 28, at which the conclusions of the report, as modified, were put to the meeting and adopted. The following are the resolutions as carried:

I.—That the proposed system of charging the consumer for the potential thermal units supplied to him is accepted.

II.—That the thermal units chargeable are to be calculated by multiplying the number of cubic feet registered by the consumer's meter by the declared gross calorific value of the gas per cubic foot.

III.—That the calorific value of the gas is to be continuously measured and recorded by a recording calorimeter of a standard type to be passed by the London Gas Referees. That the method of installing, using, and checking the standard calorimeter is to be prescribed by the London Gas Referees.

IV.—That, subject to the acceptance by the gas undertaking of the stipulations laid down in Articles I., II., III., V., VI., and VII., the gas undertaking is to be free to deliver to the consumer any mixture of combustible gases free from sulphuretted hydrogen, and not containing more than:

20 p.ct. of inert constituents for two years.
18 p.ct. of inert constituents for two years thereafter.
15 p.ct. of inert constituents thereafter.

V.—The gas undertaking to declare the calorific value of the gas it intends to deliver, and to undertake to adjust, and if need be to replace gratis the burners in consumers' appliances, with all reasonable speed; so that the gas delivered can be burned in these appliances with safety and efficiency.

VI.—Should the gas undertaking desire at any time to change the calorific value of the gas supply, due notice to be given to the consumers or their representatives. During the period of notice, preparations to be made by the gas undertaking for any readjustment of the consumer's appliances which may be required; so that the gas then to be delivered can be burned in these appliances with safety and efficiency.

VII.—The gas undertaking within a period of five years to supply gas at such pressure that, under normal conditions of supply and equipment, there shall be a pressure of not less than 20-10ths of an inch of water on the gas in any main or service pipe of 2-in. diameter and upwards.

VIII.—That the unit to be adopted in charging the consumer is to be 100,000 B.Th.U.

These resolutions were in due course handed to the Board of Trade.

On Nov. 3, 1919, in answer to a question in the House of Commons, the President of the Board of Trade (Sir Auckland Geddes) stated that he hoped shortly to introduce a Bill giving effect to the recommendations made by the Fuel Research Board in their recent report to the Board of Trade.

The central feature of the report is the recommendation that the existing system of charging the consumer for the volume of gas of a certain nominal illuminating or calorific value which passes through his meter, should be replaced by one in which he is charged directly for the potential thermal units he receives. By opponents of this change, it was argued that (as the majority of gas undertakings had adopted a calorific standard) the consumer was already in effect paying for the gas he received on a calorific basis of B.Th.U. per cubic foot. If, for example, this standard was 500 B.Th.U., then for every 1000 c.ft. passing through his meter the consumer would receive 500,000 B.Th.U. With a price of (say) 50d. per 1000 c.ft., he could if he chose consider he had purchased 500,000 B.Th.U. at a cost of 10d. per 100,000 B.Th.U. It was argued, therefore, that the proposed change of system was a mere piece of arithmetical juggling which would do the consumer no good, while it would entail unnecessary complication in the accounting between the gas undertaking and its consumers.

This argument was dismissed by the Board for what they considered sound reasons. They had before them abundant evidence that the present method of charging lent itself only too readily to the systematic delivery of gas much below the stipulated calorific value; so that, though the consumer in many cases did not receive the thermal units to which he was entitled, he still had to pay for the cubic feet of gas which had passed through his meter. The recognized methods of testing laid down in the Acts of Parliament provide no effective remedy for this state of things. Under these regulations, the tests may be quite intermittent in character, and notice has to be given by the gas examiner to the gas undertaking of the exact day and hour at which he proposes to make an official test of the gas passing through the official testing station. So long as the gas is found under these pre-arranged occasions to be of the required value, the consumer has no legal ground for complaint. The Board have had before them clear evidence in certain cases that only during the brief period of the pre-arranged test was the gas up to the required standard, and that at all other times it was much below that standard.

It would be difficult, if not impossible, to find any parallel to this state of things in any other trade or industry. Under the

Food and Drugs Acts, the protection of the consumer is of a very special kind; but even in ordinary trade practice, as controlled by common law, it is the buyer's own fault if he does not receive what he pays for. In the case of electric supply, the consumer pays for the Board of Trade units of electricity which pass through his meter; and the regularity of voltage of the current is provided for by Acts of Parliament.

It was further argued that, even if the principle of the new system were adopted, this need not necessarily involve the replacement in the bills of the consumer of the present volume unit of 1000 c.ft. by the thermal unit of 100,000 B.Th.U. The gas-meter would in any case remain the measuring instrument. So long, therefore, as the consumer is guaranteed that the gas passing through his hands contains not less than the stipulated number of potential B.Th.U., nothing would be gained by the adoption of the new unit in his bills. The change of unit, it was argued, would simply add to the confusion which already exists in the minds of the ordinary consumer, who, it was said, would neither understand nor appreciate the supposed advantages of the new method.

In reply to these arguments it was pointed out that, even to the more intelligent consumers, the present system of charging is so illogical and so far removed from ordinary business methods of buying and selling, that they may be excused if they have come to regard the situation as one which they must accept, even if they do not understand it.

Our reply to these arguments is that we have throughout felt confident that the simplicity and fairness of the new method of charging will appeal to an increasing number of consumers once it is realized by them that their future transactions with the gas undertakings will be based upon the purchase and sale of a perfectly definite commodity—namely, potential heat units in the form of gas.

Not only as it affects the immediate question of gas supply, but from the wider aspects of fuel economy, it cannot be too earnestly or too often impressed on the general public that the potential heat energy in every form of fuel is a definite quantity which can be measured in terms of a unit of which they may easily grasp the significance.

In contrast with the electrical unit established by the Board of Trade, on which the consumer pays for the electricity which passes through his meter, the British thermal unit is simplicity itself. Its definition as the quantity of heat required to raise 1 lb. of water 1° Fahr. may at first sight convey little or nothing to the ordinary person; but by the use of a few very simple illustrations even a class of children in a primary school could be made to grasp its significance. No ordinary person thinks of water in pounds, but in gallons, quarts, or pints. But anyone who is told that a gallon of water weighs 10 lbs., and a pint about 1¼ lbs., can at once visualize the pound of water as a little less than a pint. As a gallon of water weighs 10 lbs., the heat required to raise it from a room temperature to 60° Fahr. by 1° (that is, to 61° Fahr.) is 10 B.Th.U. Only the simplest arithmetic is required to make the step further of determining the number of B.Th.U. required to raise the gallon of water from 60° Fahr. to a bath temperature of 110° Fahr., or to the boiling point, 212° Fahr. The significance of the heat value of 1 c.ft. of gas of 500 B.Th.U. will be grasped when it is explained that, if this gas is burnt under perfect conditions, so that the whole of the heat is taken up by a gallon of water at 60° Fahr., the temperature of the water will be raised by 50°—that is, to 110° Fahr. As the main purpose of illustrations of this kind would be to help the learner to grasp the fundamental reality of heat measurement and of the British thermal unit as a standard unit, no reference need in the first instance be made to complications introduced by gross and net calorific values, heat losses, and inefficient combustion.

From the scientific standpoint, these illustrations may appear absurdly simple; but they are given here solely with the object of showing that, from an educational point of view, much might be done by the simplest means to give persons entirely ignorant of science a real grasp of the everyday significance of the British thermal unit. It is only necessary to add that it would be practically impossible in any such simple way to give a similar grasp of the meaning of the Board of Trade unit of electricity.

Anyone who has once taken the trouble to understand the meaning of the thermal unit will be prepared to compare for himself the cost of potential heat energy in the various forms in which it is offered to him. For instance:

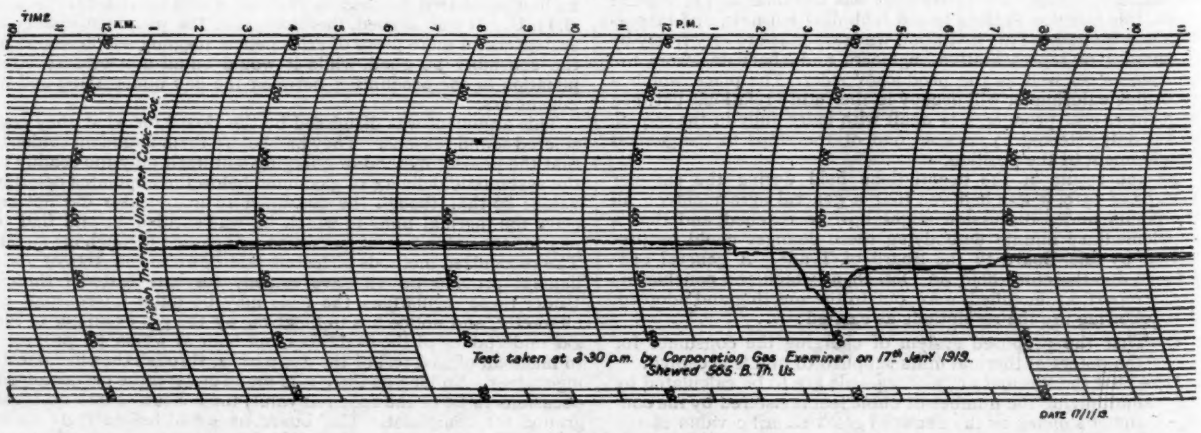
In good coal at 27s. per ton	100,000 B.Th.U. cost	1d.
,, ,, 54s. ,, ...	,, ,, ,,	2d.
In gas of 500 B.Th.U. per c.ft. at 4s. 2d. per 1000 c.ft.	,, ,, ,,	10d.
In kerosene at 2s. 6d. per gallon . .	,, ,, ,,	19d.
In petrol at 3s. per gallon	,, ,, ,,	25d.
In one Board of Trade unit of electricity for heating purposes at 2d. per unit .	,, ,, ,,	58d.

The evidence before us showed not only that the present system of testing and charging lends itself to the supply of gas which does not even on the average reach the stipulated calorific value, but that large and undetected variation in this value may occur from hour to hour. In addition, therefore, to the direct loss suffered by the consumer, there is an indirect (but none the less real) loss which occurs through fluctuations in calorific value; for it is a well-ascertained fact that gas appliances which have been adjusted for the burning of gas of one calorific value cannot efficiently burn gas of a widely different value. Irregularity in the calorific value of the gas supply, therefore, means low efficiency in its consumption, and, in extreme cases, the failure of the appliances to fulfil the functions for which they have been installed. This state of things can only be met by the establishment of the recording gas calorimeter as the standard instrument between the gas undertakings and the consumers.

In the Simmance "Total Heat-Recording Calorimeter," the calorific value of the gas passing through the distributing mains of the gas undertaking can be continuously recorded by a line traced in ink on a strip of paper, on which the hours are marked by lines ruled across the strip, and the calorific values by parallel lines ruled along it. The record is thus continuous, and the calorific value of the gas passing at any time is seen at once by noting where the line traced by the pen of the instrument passes along and across the horizontal and vertical ruled lines. The gas examiner can at any time make a check determination of the calorific value of the gas passing without interrupting the continuous record. The record slips are periodically removed from the instrument, and if desired might be regularly exposed in some public place for the inspection of consumers.

The recording calorimeter has already given tangible proofs of its value in controlling the quality of the gas supplied to consumers. A striking example of this was brought under our notice about a year ago by an association of large consumers in an important manufacturing centre. During the war the gas supply of the district had become so irregular and unsatisfactory that these consumers installed under their own direct control a Simmance total heat-recording calorimeter, and proceeded to take continuous records of the calorific value of the gas, unknown to the officials of the gas undertaking and to the official gas examiner. When the reports of the gas examiner were issued month by month, it was possible (by referring back to the calorimeter records of the days on which the official tests had been made) to see exactly what had occurred not only at the hour when the prearranged test had taken place, but during days and hours preceding and following these tests.

The record slip for the twenty-four hours from midnight to midnight on Jan. 17, 1919, is reproduced. It shows that the calorific value of the gas from midnight to 3 a.m. was 450 B.Th.U. At 4 a.m. it had fallen to 440, at which it remained until 2.15 p.m., when it rose to 460. At 3.15 p.m. a sharp rise began, which


TIME
British Thermal Units per Cubic Foot
Test taken at 3·30 p.m. by Corporation Gas Examiner on 17th Jany 1919.
Shewed 565 B. Th. Us.
DATE 17/1/19.

RECORDS OF THE CALORIFIC VALUE OF GAS TAKEN BY AN AUTOMATICALLY RECORDING INSTRUMENT ON DATES INDICATED.

The fact that the big loop in the curve (indicating a temporary great improvement in quality) synchronizes with the date and time the Official Gas Examiner made his test, is only known to the Gas Consumers' Association several weeks after the record has been registered.

continued till 4.15 p.m., when 560 was reached. A sharp fall now occurred, and by 5 p.m. 480 was reached, and was maintained till 7'45 p.m., when a further slight fall to 450 brought the calorific value back to the point from which it had started during the preceding night.

When the result of the test of the corporation gas examiner, made at 3.30 p.m. on Jan. 17, became known to the consumers' association some weeks later, they were in a position to compare their record with the result of the official test. The official test shows 565 B.Th.U. as the value at 3.30 p.m. This was in substantial agreement with the value shown by the record, which at 3.30 was 525, and 570 at 4'15. The wave of rich gas had evidently reached the calorimeter of the gas examiner some little time before it had reached the recording calorimeter; for this slight lag is similarly shown on all the monthly charts which have been submitted to us.

The record shows quite unmistakably that the consumers had been receiving for at least twenty-two out of twenty-four hours gas of a calorific value of 450 B.Th.U., while during two hours or less a wave of rich gas had passed through the portion of the distributing system from which the two calorimeters received their supply. During the passage of this rich gas the official test was made at or near the summit of the wave; and the gas was given the official hall-mark of 565 B.Th.U. per cubic foot, or 115 B.Th.U. higher than the gas consumers had been receiving for at least the preceding sixteen hours—possibly since the last test.

We consider that, while the above experiences may be regarded as exceptional, they should be referred to here, as they show how completely the present system of control can break down, leaving the consumers without any real security that they are receiving the commodity for which they are paying. Fortunately, they also show the direction in which security can be assured, through payment by thermal units received, based on the continuous records of a trustworthy calorimeter.

We believe that the gas undertakings also stand to gain by the proposed change. During recent years they have shown an increasing desire to be regarded as suppliers of heat rather than (as formerly) the suppliers of light. This has led to their seeking and obtaining powers to permit of the replacement of the illuminating standard by a calorific standard. The somewhat arbitrary and misleading "candle" standard has now been largely superseded by the calorific standard of British thermal units per cubic foot. The proposed change to a consistent thermal basis of charging is only the logical outcome of this policy. Indeed, it now appears surprising that this change in the method of charging was not from the outset made a necessary condition of the alteration to the thermal standard.

For the actual manufacturers of gas—the engineers and chemists of these undertakings—this change most naturally led to developments in the direction of converting a larger and larger proportion of the potential thermal units of the coal into the more convenient and profitable form of gas. This has to some extent been attained by the employment of much higher temperatures in carbonization, and by the admixture with the carbonization gases of water gas made from a portion of the coke. The most recent step in this direction is the practice of introducing steam into the hot coke at the lower end of vertical retorts for the conversion of some of the carbon of the coke into water gas—a process the introduction of which revolutionized the shale-oil industry in 1881.

Water gas produced under the best conditions has a calorific value of rather under 300 B.Th.U, per cubic foot, as compared with the 550 B.Th.U. of carbonization gas produced under equally good conditions. Under the new system of charging by thermal units, the gas undertakings will be free to set their own standards of calorific value. They will thus be in a position to adopt any methods of working which will result in the production and distribution of thermal units in the form of gas at the lowest price. As the consumer will only pay for the thermal units he receives, and as his appliances will be adjusted free of charge for the safe and efficient burning of the quality of gas he receives, the standard adopted by the undertaking will not affect him.

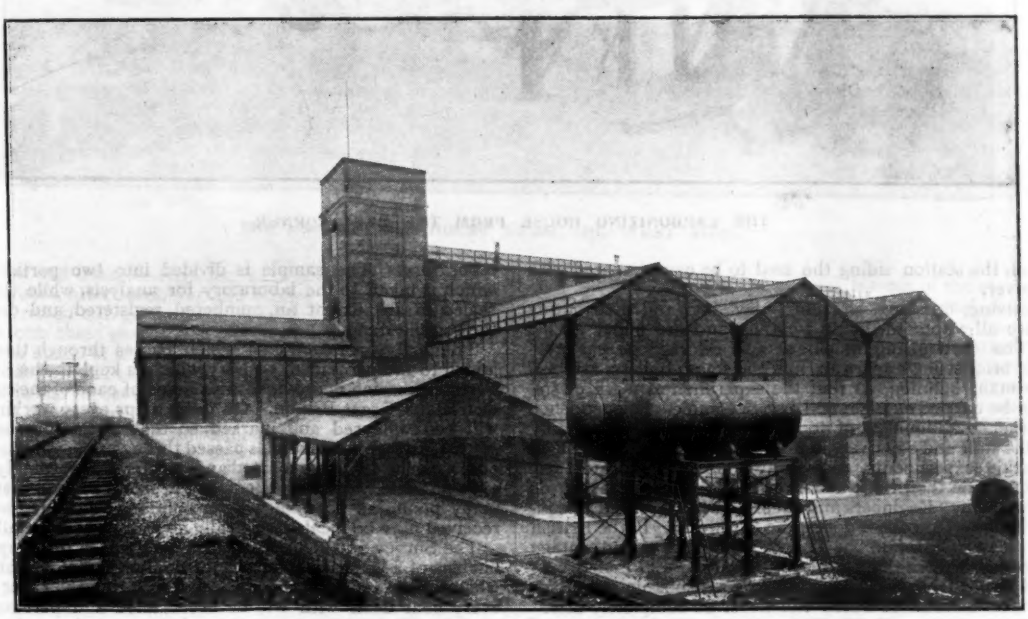
For the gas undertaking the problem is not quite so simple, for it is not merely the maker of the gas but is also its distributor. Distribution requires the provision of gasholders for storage, and mains and boosters for the conveyance of the gas over long distances and to districts at different levels. Probably not less than one-third of the total cost of the gas as it is delivered at the consumer's meter is due to these distribution charges; and this proportion will be directly increased by any lowering of the calorific value of the gas. For the storage and distribution of a gas of 400 B.Th.U. larger gasholders and mains will be needed than for a gas of 500 B.Th.U.; and the cost on this item will be increased. Unless, therefore, the thermal units in the 400 B.Th.U. gas are produced so much more cheaply than in the 500 B.Th.U. gas that the extra distribution costs are more than covered, nothing will be gained by reducing the standard to the lower figure. The great gain for the gas industry under the new system will be that no undue legislative restrictions will limit them in their development of the most economical production of thermal units in the form of gas. That there is still great scope for this development is evident from the fact that, according to present practice, only about 21 to 24 p.ct. of the total potential thermal units of the coal are sold in the form of gas.

The bearing of this question on the national aspects of fuel economy is so obvious that it is not necessary to enlarge on it further at this stage.

In concluding our account of the work of the past two-and-a-half years on this subject, we wish to express our satisfaction that the recommendations based on these inquiries have met with so wide and favourable an acceptance that the development of more helpful and more businesslike relations between the gas undertakings and their consumers is now within sight.

EAST GREENWICH FUEL RESEARCH STATION.

The following description of the new East Greenwich Fuel Research Station and its functions is taken from the report for 1918-19 of the Fuel Research Board.



THE FUEL RESEARCH STATION AT EAST GREENWICH.

THE STATION AND ITS FUNCTIONS.

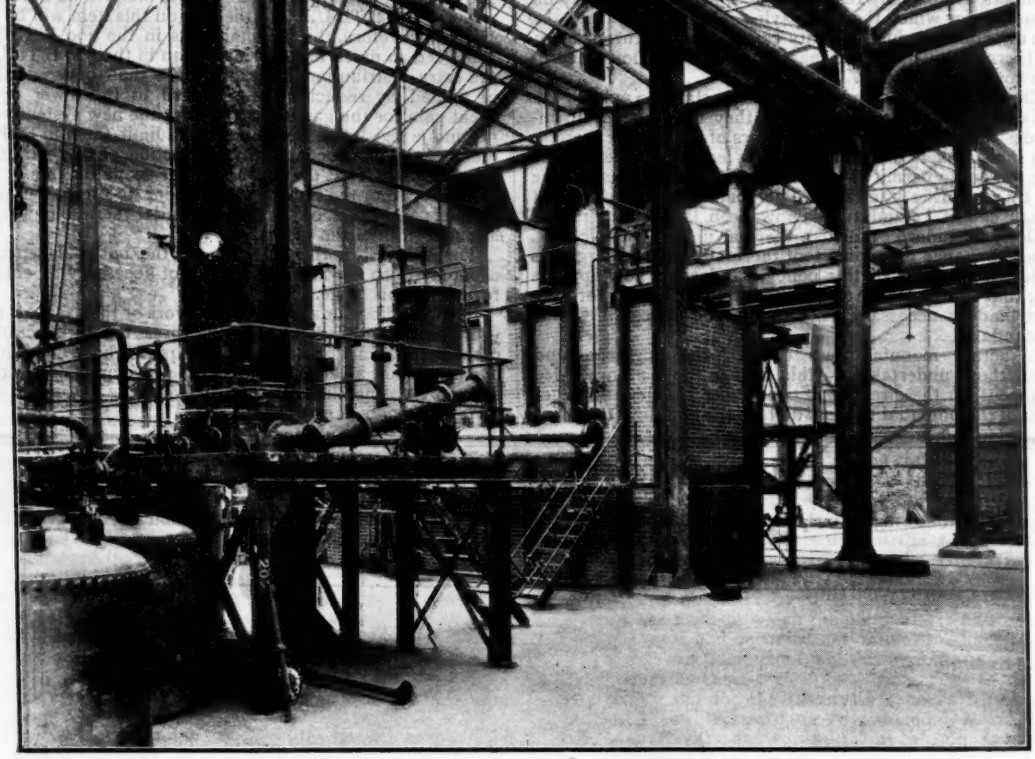
The site on which the station is erected is a strip of land about 250 ft. wide by 900 ft. long, which is bounded along its whole length by the embankment of the main siding from the S.E. Railway into the works of the South Metropolitan Gas Company. This siding is about 16 ft. above the level of the site at its west end. A back-siding for the use of the station has been laid on the station-side of the embankment; and a turntable has been built,

so that the railway wagons bringing coal for the use of the station can be turned and passed into the receiving department. A low-level siding has been laid from a point on the S.E. main-siding, along the tail of the high-level embankment, for the whole length of the site. This siding passes under the coal-receiving department, and serves either for the reception of all materials other than coal or for the despatch of coke, tar, liquor, &c., from the station.

The coal from the railway wagons is discharged into shoots leading to crushing machines, and the crushed coal is received in small wagons on a narrow-gauge line on the ground level. These small wagons are passed over a weighing machine and on to an elevator, by which they are raised to a high-level distributing system. This system, combined with the coal-receiving department, is the main artery of the whole station. By its means the small wagons are run at a height of 47 ft. above the ground on a narrow-gauge line, which crosses the station at right angles to the main sidings. Within the main building, and on either side of this line, are a series of hoppers, each capable of holding about 30 tons of coal or an equivalent volume of coke. These hoppers discharge their contents from their lower ends into the various pieces of apparatus in the main station in which coal or coke is to be treated—*e.g.*, carbonizing plant, gas producers, briquetting plant, steam-boilers, &c. The receiving department is roofed-over, so that from the time the railway wagons are pushed off the main artery of the station, the buildings are designed so that they can at any time be doubled by extending them across the site to its north boundary, the high-level distributing line being also continued to this point. On the ground level, and immediately under the high-level distributing system, is a narrow-gauge line for small wagons, by which the coke or char which results from the carbonization of coal in the retorts or other carbonizing apparatus is returned to the elevator, where it is weighed before being taken up to the high-level hoppers. From the appropriate hoppers it can be supplied to the steam-boilers, gas producers, or briquetting plant.

In combination, the high-level and low-level systems supply a complete means for the reception, preparation, and weighing of 20 to 30 tons of coal per day, for its distribution to the carbonizing or other apparatus in which it is to be treated, and for the accurate weighing of the coke or char which results from the carbonizing of this coal and its redistribution in accurately determined quantities to the apparatus in which it is to be further dealt with —*e.g.*, steam-boilers, gas producers, briquetting machines, or for direct sale as fuel for domestic or manufacturing purposes. The experimental work of the station is thus founded on the regular and accurate measuring and recording of the weight of the coal, and of the principal product of its carbonization, the coke.

The crushed coal, as it passes into the small wagons, is sampled. The sampling is under the control of the chemist of the routine



THE CARBONIZING HOUSE FROM THE EAST CORNER.

turntable on the station siding the coal to be experimented with is under cover.

The receiving, crushing, weighing, elevating, and distributing systems are all within the main building, and are under glazed roofing. The carbonizing machines and retorts, the gas producers, the briquetting apparatus, and the steam-boilers, are also within the main building, so that the experimental work of the station can be carried on night and day, in complete independence of the weather conditions out of doors. This means that not only the scientific staff and observers, but also all the workmen engaged on large-scale experiments, can at all times concentrate their whole attention on their work under the best conditions as regards their environment. Engineers and chemists who have had to conduct experimental work out of doors, and at the mercy of the British climate, will, we believe, be the first to appreciate the advantage not only to the workers themselves, but even more to their work, which will result from the reduction to a reasonable minimum of the physical discomfort which can never be completely dissociated from experimental work done on an industrial scale. Further, to ensure for the workers a healthy atmospheric environment, a complete system of ventilation by means of electric fans has been installed in the main building. The risk of gas explosions and of "gassing" accidents will also, it is hoped, be reduced to a minimum by the positive removal of foul air and gases.

The coal receiving and high-level distributing system being the laboratory. The sample is divided into two portions, one of which is taken to the laboratory for analysis, while the other is sealed in an airtight tin, numbered, registered, and deposited in the sample room.

The analysis of each coal which passes through the station is added to the permanent registry which is kept in the Survey Department, which is provided with maps of each of the coal-mining districts of Great Britain. On these maps every working coal-pit will be numbered and marked, so that all samples sent to the station, and all bulk samples passed through for experimental purposes, can be definitely located and registered accordingly. Whenever possible, vertical sections of the strata in each district at as many points as possible will be obtained; so that the samples received may be located vertically as well as horizontally.

The Survey and Registry Department will in this way form the nucleus of a general survey of the coal-seams of Great Britain; while for the experimental work of the station the exact source of every coal dealt with will be ascertained and permanently recorded. The larger proportion of the coals located and registered will come to the station in the form of samples carefully cut either from the whole thickness of each seam, or of portions which are kept separate in actual working. These samples will be cut at the mine-face under skilled supervision, will be at once placed in airtight vessels, and forwarded to the station, where they will be submitted to examination and analysis by standard methods.

From among the coals thus examined and registered will be selected a limited number, which are regarded as most suitable for the experimental work of the station; and samples will be carefully taken so that they represent the average of the deliveries received during an experimental run.

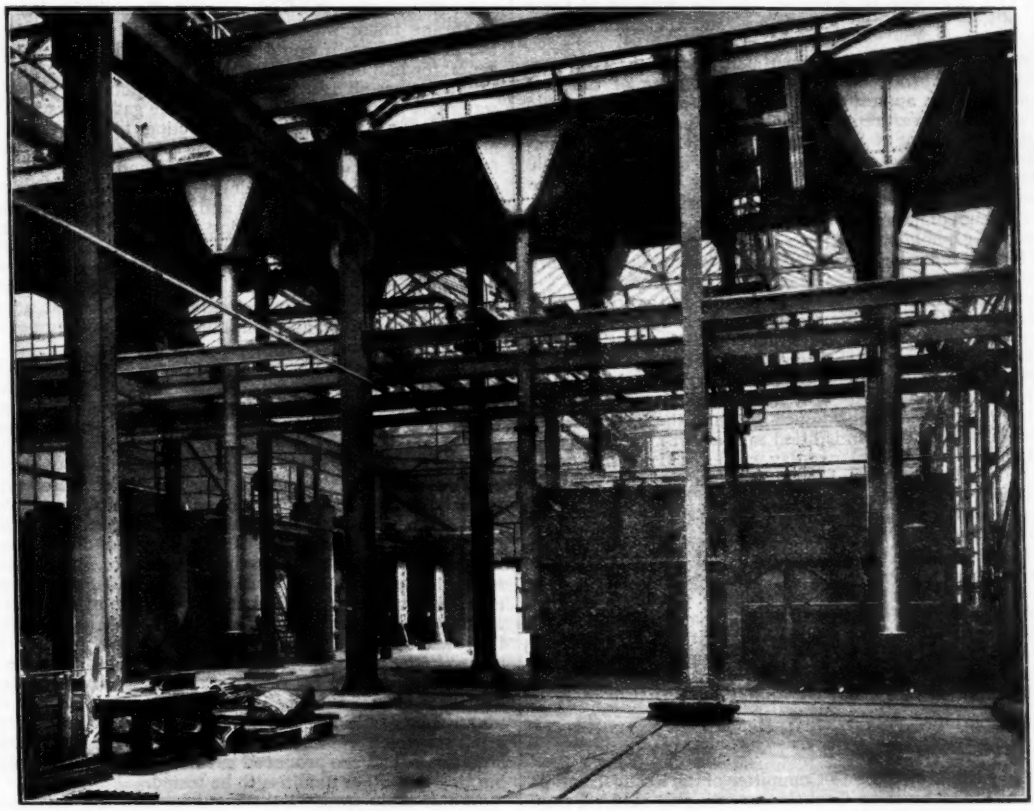
The next in order of the fundamentals of the station is the supply of fuel gas for the heating of retorts and carbonizing apparatus generally, and for use in experimental furnaces. In all experimental apparatus of these types, it is of the first importance that the heat expended in regular working should be accurately known. The first item in any thermal balance-sheet must always be the thermal units actually supplied. Thermal units for high temperature operations can be most easily supplied and most accurately measured in the form of fuel gas of uniform calorific value. If the gas is passed through suitable meters to determine the number of cubic feet consumed, and if the calorific value per cubic foot is regularly determined and maintained, the thermal units actually supplied over any period is very simply obtained by multiplying the number of cubic feet passed by the calorific value per cubic foot. For the fundamental fuel of the station water gas has been adopted. Water gas is of high calorific value —being easily produced in regular practice to a standard of 280 to 290 B.Th.U. per cubic foot. Its flame temperature is high, and it is entirely free from tarry impurities. For these and other reasons, this gas has been adopted; and a water gas producer of the Humphreys and Glasgow type has been installed. The gas from this producer, after scrubbing and cooling, passes to one or other of two 20,000 c.ft. gasholders. The fuel-gas distributing system starts from these gasholders, which will maintain a steady pressure on the mains of about 4 inches of water. The water gas supplied to each piece of experimental apparatus passes through a meter; and in the furnaces constancy of supply is maintained by diaphragms of standard sizes.

While water gas is to be the standard fuel-gas used in the station, arrangements can at any time be made for its replacement by other fuel gases of either lower or higher calorific value. For all experimental work the use of a standard gaseous fuel has advantages which more than compensate for the initial cost involved in the establishment of a complete organization and equipment for its production, distribution, measurement, and combustion under strictly controlled conditions.

The distribution of air under positive pressure, and its direct measurement and control at the point of combustion of the fuel-gas, is only second in importance to the organization of the gas supply. With an abundant supply of air at constant pressure and always available, combustion furnaces and chambers can be worked under a slight positive pressure so that excess of air is not drawn-in to lower the temperature as well as the efficiency. The exact proportion of gas and air can be maintained steadily; and the maintenance of a given temperature in furnaces or muffles can be ensured with regularity and accuracy. It becomes, therefore, not only possible but easy to draw-up accurate thermal balance-sheets for almost any type of operation or apparatus.

The station is thus equipped for the production of exact thermal balance-sheets for operations conducted on an industrial scale. In this respect, it will be the counterpart of the National Physical Laboratory, which is universally accepted as the standard authority on the standardization of physical units and constants. It is intended that the station shall supply engineers, metallurgists, and chemists in charge of manufacturing operations with trustworthy data on the production and use of heat, which will enable these experts to check the efficiency of existing methods, or, when designing new forms of apparatus, to calculate the units of heat actually required under the best practical conditions.

For good and obvious reasons, the scale of the operations to be carried out at the station had to be fixed at the minimum which would give results under conditions which manufacturing experts could be expected to accept as safely translatable into everyday practice. From the experimental point of view the best scale to adopt is the smallest which will give the required data. The larger the unit-scale, the more costly will be the experimental work in apparatus, in labour, in supervision, and last (but not least) in time. The shorter the time covered by each experiment the larger will be the number of experiments which can be carried out over a given period, and the wider will be the area covered by the inquiries. While the general lay-out of the station, with its high-level and low-level sidings and its internal distribution system, would obviously (if need be) lend itself to the handling of relatively large quantities of coal per day, the maximum unit-scale which has been in mind from the outset has been from 20 to 30 tons of coal or coke per day. It is clear, however, that a great deal of the most useful work can be done on a considerably smaller scale than this. The question of the unit-scale as it affects particular departments of the station will be referred to more fully later.



THE CARBONIZING HOUSE FROM THE WEST SIDE.

Electricity has been adopted as the motive power for the station. A 100 H.P. gas-engine and dynamo have been installed, and a complete distribution system has been fitted-up, so that electro-motors can be used in any part of the station. As a stand-by to the gas-engine a set of Diesel engines and dynamo is being installed; but this is referred to in another connection. A further stand-by is being provided by a storage battery of 120 cells, the primary use of which, however, will be to supply large currents at low voltages for use in the laboratories.

For the maintenance of a steady supply of steam throughout the station, a Cochrane boiler has been installed; and for the more serious evaporation tests with different kinds of fuel, a water-tube boiler, with certain special features, is also installed.

The water supply for the station is obtained from the mains of the Metropolitan Water Board. A store tank, holding about

15,000 gallons, is placed on the top of the central tower. A water-softening apparatus is installed immediately under the tank.

In addition to the low-pressure air supply for combustion purposes, high-pressure air is supplied for the blowing of oils and liquors from the measuring tanks to the store tanks.

For the carbonization experiments, two pieces of apparatus have already been installed. One of these is for the carbonization of coal at temperatures ranging from 500° to 600° C. The other is a setting of four Glover-West continuous vertical retorts, estimated to carbonize 10 tons of coal per day. A third apparatus for carbonization at 500° to 600° C., has been erected at the maker's works, and its mechanical working has been tested at ordinary temperatures. The completion of this apparatus is being held-up in order that effect may be given to the fuller knowledge of the behaviour of different types of coal during carbonization at temperatures from 500° to 600° C., which is being obtained by the experimental work at the station.

Much time during the past two years has been devoted by the Director and Mr. Burton to the design of an apparatus for carbonization at low temperatures. The two forms which are referred to above are regarded as only the first steps in this development. But there is no doubt that with these forms all the data as to the products to be obtained from any given coal at any given temperature, up to 600° C., will be obtained with a certainty which has never yet been reached on a steady working scale. Not only the exact quantities of the products, gas, petrol, oils, ammonia, and coke will be obtained, but the qualities of these products will be tested and ascertained, and their commercial value can be assessed.

In laying-out the station for experimental work on coal carbonization and its products, it was recognized as of the first importance that the apparatus for the collection of the volatile products and their measurement should be as perfect as possible in the light of the best modern gas-works practice. This apparatus includes: Condensers for the separation of tar and volatile hydrocarbons; washers and scrubbers for the separation of the last traces of ammonia and hydrocarbons; purifiers for the separation of sulphur compounds; meters for the measurement of the gas produced; gasholders for its storage; separators and measuring tanks for the measurement of the liquid products; and store tanks for the collection and distribution of these products.

This section of the station had to be designed so as to be available for dealing with the gaseous and liquid products from any form of carbonizing apparatus. Its functions being, in the main, of a thoroughly permanent character, and not likely to involve any but relatively trifling alteration to render it suitable for the different types of carbonization, it was regarded as the truest economy to lay the section down once for all in the best possible way. The plant as laid-down is fitted to deal with the gases and products from 10 tons of coal per day, carbonized at high temperatures in continuous vertical retorts, or from 20 tons of coal per day carbonized at low temperatures in any form of apparatus which may be designed and erected for the purpose.

For the regular steam supply of the station, a Cochrane boiler has been installed. This boiler will be useful for certain kinds of experimental work; but for regular testing work a water-tube boiler, with an evaporative capacity of 5000 lbs. per hour, has also been installed. This boiler is fitted with a chain-grate for automatic stoking, and with fans for forced draught. A testing plant with feed-water tanks, a condenser, and the usual accessories for this type of work, is at present being fitted-up. Arrangements for oil and gas firing tests are under consideration.

Survey of the National Coal Resources from the Physical and Chemical Points of View.

During the sittings of the Sub-Committee of the Reconstruction Committee of the Cabinet on Coal-Conservation in 1916-18, consideration was given to the desirability of organizing a survey of the national coal resources, not only on the geological and mining side, but also on the chemical and physical side. During these discussions, it became evident that the latter side of the survey was approached by those members who were specially interested, from two points of view, which, however, were never very clearly distinguished in the discussions. On the more academic side, it appeared to be assumed that the survey should be founded on an exhaustive scientific study of the origin and properties of the definite chemical compounds of which coal is built-up. In this study scientific workers in Great Britain and other countries have been engaged for many years.

On its more directly practical side, the survey was intended to deal with the coal-seams as they are, or might be, mined and put on the market, and to ascertain and to affix to each an account of its proximate composition and qualities. The survey, if systematically carried out, would bring into notice unworked seams or parts of existing workable seams which, while unsuitable for general use, might be well adapted for particular purposes. To take only one example of this type of inquiry—the suitability of coals for the preparation of metallurgical coke. It is common knowledge that the highest types of coking coal—as these are at present rated—are only found in a limited number of coal-mining areas. This limitation is specially marked in the mining areas of Scotland. During the war pressure was brought on the Scotch iron and steel makers to increase the output of their products. Any such increase at once involved the production of a correspondingly greater quantity of metallurgical coke. To meet this larger demand from the seams of coal then being worked for coking purposes, was impossible; so that a survey of all coals which might be brought into the coke-producing group was organized by the Ministry of Munitions Scottish Advisory Committee on Iron and Steel Production, who placed the testing side of the survey in the hands of Prof. Thomas Gray, of the Royal Technical College, Glasgow. As a result of this organized survey, 300 to 400 seams were sampled and tested, first by laboratory methods, and finally by large-scale operations, with the result that information regarding the comparative coking values of the coals examined is now generally available to the coal-distilling industries.

The Work of the Station.

In May last, the buildings and plant at the station were still a long way from completion; and the progress of the work was disappointingly slow. Towards the end of July, however, the work had reached a stage when it appeared desirable that a definite programme should be drawn-up for the pressing on of such parts of the plant as would be required for the preliminary experimental work on the carbonization of coal at temperatures from 500° to 600° C. The time tentatively fixed to start this experimental work was the beginning of September. The proposal was that, by this date, the setting of nine steel retorts should be completed and heated to a working temperature, and that the condensers, exhausters, scrubbers, purifiers, and gasholders should be connected-up and ready to deal with the oils and gases produced by the carbonization.

By Sept. 1 the retort-setting was all ready for heating-up, the Cochrane boiler was in commission, and steam was available at the points where it would first be required. The gas-engine and generator had been in commission for some weeks; and the wiring to the motors all over the works was practically complete. The water-gas plant was in commission, the gasholders had been filled with water gas, and the pipe connections to the retort-setting were nearing completion. By Sept. 8 the retort-setting was being gently fired to dry and warm the brickwork; and the positive air supply required to raise it to a working temperature was being connected-up. By Sept. 15 the fuel gas and air supplies were connected-up to the retort-setting, and heating-up to a working temperature was started. During the following week experimental work was carried out on the management and regulation of the heating-burners in the retort-setting; and, by the end of the week, complete control had been secured. Pyrometers were installed at a number of points in the setting, and continuous records of temperatures and gas consumption were made.

The method of laboratory assay in which the gas, liquor, oil, and coke from the carbonization of 30 grammes of coal at any desired temperature, (say) from 500° to 600° C., are accurately weighed or measured, has proved invaluable as a means for the first selection of coals likely to be suitable for carbonization. But for the further selection, from among these, of the coals most suitable for carbonization on an industrial scale, experiments under the large-scale conditions of heating and working are necessary. The setting of steel retorts was designed expressly for the carrying-out of this work. By means of a common main, the nine retorts are connected to the full-scale condensers, exhausters, meters, scrubbers, purifiers, and gasholders. Provision has, however, been made for the isolation of any one of the retorts and its connection to a small condensing and metering installation, for the collection and measurement of gas, liquor, and oil. With this arrangement the behaviour of coal in charges of from 2 to 3 cwt. can be tested under large-scale conditions as regards the heating and the disposal of crushed and graded coal in layers of any thickness. The resulting gas, oils, and coke, therefore, represent the products which would be obtained under definite conditions on a large scale, and are produced in sufficient quantity to enable their burning and other qualities to be tested.

At this early stage in the inquiries into the carbonization, it is evident that the relative ease and speed in experimenting with a single retort, as compared with a large number of similar retorts, is of great advantage. The small quantity of material to be handled in each experiment, the short time occupied by a complete experiment, the small amount of labour required, and the light demands on coal supplies, all combine to justify the use of the single retort. Obviously, several complete experiments can be carried out in one day; so that in a few weeks a range of experimental work can be covered which would take many months if done with the full setting of retorts in continuous work. Of course, at the next stage the results obtained must be put to the test in the full-scale unit in continuous work. Meantime, the staff have become familiar with heat regulation for temperatures from 500° to 600° C., as well as with the fundamental conditions of carbonization at these temperatures. More than fifty trial carbonizations have been carried out, and valuable data are accumulating almost too rapidly, in view of the very limited number of the available scientific staff.

The preparation of the coke made in the form of a smokeless domestic fuel, which will be sufficiently strong to stand the rough handling of transport while retaining its excellent qualities as a fuel, is receiving the closest attention, and is, indeed, being dealt with as a question of the first importance. In this direction encouraging results have already been obtained; and arrangements are being made for testing this fuel in domestic grates, under scientific supervision and under ordinary conditions.

Before leaving this subject, it is of importance that it should be clearly understood that, while the present experimental work on carbonization with the setting of steel retorts is yielding, as

has been shown, most valuable information, the setting in itself was neither intended nor expected to give more than a very partial solution of the problem, with regard to the evolution of a practical and economical apparatus from the engineering point of view.

Towards the end of October, the setting of vertical retorts was sufficiently advanced to allow a beginning to be made in heating it up; and since then it has been gently fired. The setting is fired by water gas; the air necessary for its combustion being supplied under positive pressure. To meet these conditions, an entirely new design for pre-heating the air has been evolved; and the regulation of the gas supply is also on new lines. It is therefore to be expected that at the outset some time will have to be spent in working-out the conditions necessary for the regular and easy control of this heating system, and in making any alterations in it which may be found necessary. No attempt will be made to put the retorts into commission as a carbonizing unit until the heating arrangements have been thoroughly proved.

When this stage is reached, the unit will be run on the steady production of town gas; measured quantities of steam being introduced at the lower ends of the retorts. In this way, it is expected that data will be obtained from which accurate thermal balance-sheets can be drawn-up for different amounts of steam and for different temperature conditions. To ensure that the weight of steam entering the retorts is accurately measured, a small gas-fired steam-boiler is being installed for the exclusive use of the retorts. The gas produced will pass through a meter on its way to one of the station gasholders; and its composition and calorific value will be regularly determined.

As the heating of the vertical retorts is carried out in seven horizontal stages, the temperature grade in the vertical column from top to bottom can be varied at will, and the effect of these variations on the output of gas and on the qualities and quantities of the gas, tar, ammonia, and coke produced can be determined, while the actual consumption of thermal units in the operation will be ascertained.

Under the arrangement with the South Metropolitan Gas Company, the surplus gas, tar, liquor, and coke will be passed over to the Company's works and duly credited to the station.

GAS FOR BRASS MELTING.

A Lecture by Mr. L. F. Tooth.

The April business meeting of the London and Southern District Junior Gas Association, which was held last Friday evening, at the Westminster Technical Institute, was devoted to a lecture entitled "Gas Apparatus Used during the Late War in connection with the Manufacture of Fuses, &c." The lecturer was Mr. L. F. Tooth, M.B.E., of the Commercial Gas Company, a Past-President of the Association. As a matter of fact, there was not a great amount about gas in the lecture; and therefore it is impossible for it to find place *in extenso* in the pages of the "Journal." The subject upon which attention was focussed was "G" brass—a metal used chiefly for fuses, primers, nose-bushes, and other component parts of shells; and about this the audience learned a great deal. It is a matter of which Mr. Tooth is a proficient exponent; for, in addition to his many years of special work on furnaces for metal melting, he acted from 1915 to the end of the war as Technical Adviser to the Non-Ferrous Metal Section of the Ministry of Munitions, supervising and controlling the manufacturing operations of a large number of works in London and other parts. It was pointed out by the President (Mr. S. B. Chandler, of the South Suburban Gas Company) that Mr. Tooth had supervised twenty-three firms in London, arranging for plant, &c.; and within twelve months these firms were turning out 1400 tons of metal per week. A feature of the lecture was the varied assortment of samples and lantern slides by which it was accompanied.

Mr. Tooth said that, with the objects of the Association in view, it occurred to him that even wider co-operation of the members is demanded. Those who did not give their services in the field should not hesitate, or be reluctant, to freely communicate to others the knowledge and experience gained during the war, which in some cases have been very extensive. Since his lectures to the Association early in 1914, the industrial application of gas has advanced considerably. While the industry as a whole rendered vast services to the Empire in many spheres during the war, he drew attention to the success that coal gas achieved as a fuel in the manufacture and output of munitions—thus demonstrating that the pioneer and development work had not been in vain. Coal gas has undoubtedly established its value and utility in almost every trade; and continued progress can only be retarded by lack of support and foresight. Manufacturers to-day realize the potential advantages of coal gas as a fuel; and in view of the ever-increasing charges incidental to solid fuel—such as labour, transport, storage, the disposal of ashes, overhead works charges, &c.—only diligence is required to open-up a vast field for the utilization of gas. From a manufacturer's point of view, the main outstanding factor is money—or, in other works, the extent of his fuel costs—as it must be acknowledged that in the majority of trades the fuel bill is of primary importance. Members of the gas industry who are concerned with the sales of gas for industrial purposes must not be content to act as salesmen only, but must make themselves thoroughly acquainted with every industry and manufacture they are likely to meet. In fact, they must become "Trade Specialists," so that they are able to educate customers in the commercial possibilities of gas.

In the early period of the war there was a great demand for "G" brass, which is a metal now generally known as 60/40, or really Muntz metal; being, when heated, suitable for forging into shape, or for being drawn, rolled, stamped, or extruded. It can also be welded, though this is not generally known. The composition is copper 60 p.ct. and spelter 40 p.ct.—with slight percentages of other metal for certain purposes. The term 60/40 is rather misleading, as in practice the average chemical content which gave the most satisfactory result was: Copper, 59 p.ct.; spelter, 39 p.ct.; lead, 1·5 p.ct.; and impurities, 0·5 p.ct. It must be understood that extreme care is required in the manufacture of the metal. A shell-nose had to stand a considerable strain and stress; and, further, an excess of 2 p.ct. of lead content had very serious consequences.

Dealing at length with the method of manufacture, the lecturer remarked that the pouring of metal into chills requires extreme care; and it is absolutely essential for it to be poured dead centrally. In no circumstances must it touch the sides; otherwise the billet will become pitted or rough on the outer side, and have what are known as "cold-shots." A dead cold chill is also very detrimental, as the metal would too quickly solidify, causing "piping" or imperfect crystalline structure; while, on the other hand, a chill which is too hot will not allow the metal to cool sufficiently to prevent it becoming pitted. The temperature at which the metal is poured must also be taken into consideration. If poured too cold it will solidify in layers, and produce internal blow-holes in the billet. For making a perfect stamping or extruded rod, there should be an entire absence of cold-shots, pitted surfaces, and blow-holes.

According to the type and weight of stampings to be made, bars would be cut into sections (called slugs) of a given length. The slugs were then heated, taken to a drop-hammer or press, and stamped into shape. The annealing of the slugs for stampings and the billets for extrusion is of extreme importance; and the most satisfactory results are obtained in gas-fired furnaces. At a temperature of 750° C., 60/40 metal becomes plastic, and can be forged into any desired shape with perfect surfaces. In annealing, it is essential that a reducing atmosphere is present in the furnace. Care must be taken, when heating or annealing the slug, that it is thoroughly soaked; otherwise the core will cause cracking, or the structure will become laminated. As for extrusion billets, these would be annealed, in precisely the same manner as the slugs, up to a temperature of 750° C.; but the period for annealing would be considerably longer, in order that the billet should be thoroughly soaked through.

In coke-fired furnaces there are—in addition to the skimmings to be treated—ashes, &c., which pick-up a great deal of metal, owing to spilling while stirring or puddling the metal in the crucible in the furnace. This naturally entails an increased cost in treatment, as compared with the skimmings from a gas-fired furnace. Ashes should not contain, if careful working be practised, more than 6 to 8 p.ct. of metal. Skimmings which are removed from the metal itself contain from 30 to 50 p.ct. If the amount is in excess of 50 p.ct., it tends to show imperfect working.

Mr. Tooth described the method which he has found most successful in practice for the recovery of metal from ashes and skimmings; and he then went on to compare the different systems of firing furnaces, from his actual experiences in his work during the war. With coke-fired furnaces, he said, the method is to place the pot in the furnace, and bank-up the sides with fuel. With such an arrangement, control of temperature is practically impossible. Irregular fuel consumption, variation of draught, disturbance of furnace when pouring, and other factors, render it unlikely that any two charges will receive the same treatment. As a consequence, the product varies considerably, both chemically and physically. Further, a furnace cannot be worked continuously over an extended period. In oil-fired furnaces better control is obtainable; but owing to the large flame-volume and the high flame-temperature, a great degree of skill is required to prevent overheating and boiling (which renders the metal unfit for pouring), and also large losses by volatilization. Trouble is also caused by sulphur. On the other hand, with gas-fired furnaces the control is elastic. It is possible to regulate the temperature accurately and standardize the working, thereby ensuring a uniform product. As an example, a battery of fourteen gas-fired tilting-furnaces running "swarf" (or scrap) continuously day and night, gave an average of ten melts per 24 hours per furnace, yielding a practically uniform product; the variation of copper content being only ½ p.ct. When running ingots or bar or billets the average was twelve melts per 24 hours per furnace. In coke and oil furnaces the life of the pots was thirty heats; while with gas the average went to over fifty heats.

In bringing his lecture to a close, Mr. Tooth emphasized strongly the following three points:

1. The great future of gas for industrial purposes.
2. The necessity for "trade specialists."
3. The need for educating manufacturers in the possibilities of gas.

The President remarked upon the great amount of work which the preparation of the lecture must have entailed; and a hearty vote of thanks was accorded Mr. Tooth, on the proposition of Mr. F. J. Pearce (the Senior Vice-President), seconded by Mr A. B. Chandler (Gas Light and Coke Company

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The members of the Association visited the historic borough of Colchester last Wednesday for their Half-Yearly Meeting; Mr. W. W. Townsend, the Engineer and Manager of the Gas Company, being the President this year. Including guests, the number that assembled at the George Hotel for luncheon was about ninety. This hospitality was due to the Chairman (Alderman W. Gurney Benham, J.P.) and the Directors of the Company; and at this inaugural item in the day's programme, the Chairman himself presided. The Vice-Chairman (Major N. A. C. de H. Tufnell) was also there, with two of his colleagues—Mr. R. G. Craske and Mr. O. Thompson Smith. The Mayor was unavoidably prevented from attending; but the Town Clerk (Mr. H. C. Wanklyn) was present, as was also Dr. W. F. Corfield, Medical Officer, as well as several members of the Council.

After lunch,

Mr. F. Prentice (Ipswich) proposed the toast of "The Colchester Gas Company." He remarked that he did not think there was any other industry in this country which employed millions of capital and hundreds of thousands of men that had largely increased its turnover and at the same time decreased its profits. In this respect the gas industry occupied a position of splendid isolation. He was not sure that a better word would not be "damnable" isolation. The industry had suffered in consequence. In his opinion, the top, bottom, and all through this were Government interference and restrictions. The days of monopoly for gas had passed. Lighting, cooking, and heating could be done by oil. They could light their houses, and partially cook their dinners, and warm their rooms by electricity; but the cheapest and really most effective method was by gas. The monopoly, however, had gone; and therefore many of the restrictions ought to have gone with it. But instead he saw that morning that the Government were going to make another demand in the shape of 5 per cent. from the profits of all those gas companies that happened to be limited liability ones; and consequently he thought they would have to be careful how they trod and the way they went. He noticed that the Government did not treat the miners, or the railway men, or the shipping industry, the same way as they did the gas industry. They might ask the reason why. He thought it was because the other people had a nasty habit of "getting on to their hind legs, and showing their teeth." It was a question whether the time had not come, or had long since passed, when the gas industry should take a leaf out of the books of the miners, the railway men, and others, and stand together and make demands for that justice to which he thought the industry was entitled. The Colchester Gas Company were fortunate in having an Engineer like Mr. Townsend. He was a man who had won their respect, and whose advice was greatly sought after. He in his turn was exceedingly fortunate in having such a Chairman as Alderman Gurney Benham—a man whose eyes were open wide to see far. He (Mr. Prentice) had not the slightest doubt as to success attending the Colchester Gas Company; and he therefore submitted the toast with great pleasure.

The Chairman, on behalf of the hosts, thanked the visitors heartily for the way they had received the toast, and Mr. Prentice for his very inspiring, useful, and cordial speech. He (Alderman Gurney Benham) could make a long speech about the Colchester Gas Company; but he must refrain. This was really the Centenary Year of public gas lighting in Colchester, and it would take a long time to go over a hundred years' history. On behalf of the Directors of the Company, he heartily welcomed the visitors to Colchester. They considered it an honour that the Association had come to the town, and an honour to the Company that they had selected their Engineer and Manager as their President. He was going to propose "The Health of the Eastern Counties Gas Managers' Association," coupled with the name of Mr. Townsend. Out of adversity, good results sometimes sprang; and one result of the war had been that in their industry there had come greater co-operation, harmony, and unity between gas undertakings. It was a very important thing that this should continue—important not only in the interests of the undertakings themselves, but of the public. They knew in Colchester what a large and increasing demand there was for their product, and how useful it was for all classes—from the top down to the humblest cottager. Everybody wanted gas; and everybody could make good use of it. There was a great future for all gas undertakings. The Colchester Company had every prospect of great success; and one reason they had this outlook was because they had an excellent Manager in Mr. Townsend. He (the Chairman) believed the first duty of a gas company's director was to see that the company had a good engineer and manager. The Board took great pains in regard to the selection of theirs; and they had the utmost confidence in Mr. Townsend. He knew perfectly how well they valued his services. They were on terms of the utmost cordiality with him; because he hoped and believed Mr. Townsend had reason to have confidence in his Directors, and his Directors confidence in him. They were at the present time spending a great deal of money altering the works; and this outlay they were convinced would be highly productive.

The President acknowledged the hearty way in which the toast of the Association and of his own health had been drunk. The Chairman had given him a difficult task to reply to the toast in adequate terms. From the time he first came to Colchester, the Directors had treated him with remarkable kindness and courtesy. They had backed him up in every possible way; and to them was due a great deal of credit for the present position of the Company. Mr. Prentice had told them something about the unfortunate position of gas companies, which was due to Acts of Parliament limiting dividends, and making them depend upon the price of gas. They had a very fair increase of consumption; and if it were not for these restrictions, the gas industry would be as prosperous as any other in the country. As to his Chairman, he might say that, whether as Commandant of the volunteers or as Chairman of the Gas Company, they were all proud to be under him. He was the most tactful, genial, and versatile man he (the President) had ever had to do business with. As to the position of the gas industry, it was a remarkable fact that a hundred years' progress had not found the industry settled down to a standard method of working. It might have been thought that, after a hundred years, everything would have been stereotyped. Instead of that everything was in the melting-pot, and new processes were constantly being brought out. There had never been a more interesting period than this in the history of the gas industry. The changes that had come about in consequence of the war had rendered it necessary to revise their methods. They could not go on in the ways of 1870. The result was there was an astounding number of new processes and inventions being put on the market; and it was a difficult task for anybody who had to run the gas business to keep up to date. It was by Associations such as this that they endeavoured to keep in touch with all that was going on. The Eastern Counties Association had been in existence for thirty years; and it had not by any means exhausted the possible subjects for consideration.

THE BUSINESS MEETING.

The Business Meeting was held in the afternoon in the Grand Jury Room at the Town Hall—the President (Mr. W. W. Townsend, of Colchester) presiding.

Minutes Confirmed.

On the suggestion of the President, the minutes of the last meeting were taken as read, and confirmed.

Regrets.

The Acting Hon. Secretary (Mr. H. R. Wimhurst, Bury St. Edmunds) announced that he had received several letters of regret, expressing inability to attend the meeting. One of them was from Sir Dugald Clerk, who had a prior engagement on a Committee in London, and who greatly regretted he would not be able to be present. Mr. A. E. Broadberry, of Tottenham, and Mr. C. F. Botley, of Hastings, were also unable to attend.

Hon. Members.

The Hon. Secretary said the Committee suggested that the names of three gentlemen who had retired from active service in the industry should be added to the roll of their honorary members. They were Mr. Harry Wimhurst, Mr. J. G. Hawkins, and Mr. John Young.

Mr. E. W. Smith (Chelmsford) proposed, and Mr. C. G. Grimwood (Sudbury, Suffolk) seconded, that the gentlemen named be elected honorary members.

This was cordially agreed to.

Mr. Wimhurst, on behalf of himself and Messrs. Hawkins and Young, heartily thanked the members for the honour conferred upon them.

New Members.

The Hon. Secretary stated that the following nominations for membership and associate membership had been received:

Members: Mr. W. A. G. Hardy, of Beccles; Mr. Samuel Hands, of Sleaford; Mr. E. J. Fussell, of Tottenham; and Mr. Alfred Gregory, of Harwich.

Associate Members: Mr. John R. Masters (Messrs. Gibbons Bros.); and Mr. John Green, of Wisbech.

Moved by Mr. G. A. Mallett (Ipswich), and seconded by Mr. H. G. Ruggles (Leighton Buzzard), it was decided to add the names to the roll.

Report and Balance-Sheet.

The Hon. Secretary submitted the report and accounts. The concluding paragraphs of the former stated:

The year commenced with a membership of 131. During the year, twelve new members and one associate member were elected, and eight members resigned; the majority of the latter having retired from the profession. Six members severed their connection with the Association under Rule 20. The Committee regret to report the death of Mr. W. J. Carpenter, of Yarmouth, Mr. J. T. Jolliffe, of Ipswich, and Mr. J. G. Glover, of London. The total membership at the end of the year was 127.

The accounts show a balance in hand of £12 8s. 5d.—the revenue received amounting to £96 18s. 6d., and the expenditure to £76 3s. 5d. There was a deficit brought forward of £8 6s. 8d.

The Committee wish again to impress on members the valuable work which is being done by the Commercial Sections, also the importance to the industry of supporting to the fullest possible extent the National Gas Council and the Federation of Gas Employers.

Mr. J. W. Auchterlonie (Cambridge) proposed the adoption of the report and accounts; and, in doing so, he congratulated the late Hon. Secretary and Treasurer (Mr. F. M. Paternoster) on having left the accounts with a balance in hand.

Mr. H. Wimhurst (Sleaford) seconded the motion. He remarked that a regrettable feature about the report was the death

of their friends Mr. Jolliffe and Mr. Carpenter. The former was a gentleman who had taken an interest in the Association from its commencement in 1888. He as well as the other members had always found him to be a gentleman and a friend of the highest order. He would ask the members to rise in their places, and so silently express their feeling over the great loss they had sustained.

The members having carried out Mr. Wimhurst's suggestion, the report and accounts were passed.

The President then read the following

INAUGURAL ADDRESS.

My first pleasure and duty is to thank you sincerely for the honour you conferred upon me in electing me to this office. It gives me great pleasure also to welcome you as visitors to this ancient and historic borough; and I hope that the programme arranged will prove interesting and instructive, and that you will all carry away pleasant memories of the meeting.

Times have changed in many respects since these half-yearly gatherings were the only opportunities for conference afforded to our members. In those bygone days the Association necessarily had to deal with a large variety of questions, technical and administrative. The Commercial Sections were the first development; and now we have the National Gas Council, with its District Boards, and the Federation of Employers, and (latest of all) the Regional Gas Council.

These various bodies meet frequently to discuss administrative, commercial and labour affairs. Those who take an active part in this work find their time and attention more and more devoted to the matters of pressing importance which come before them in that capacity, and sometimes heave a sigh of regret for the days when they could settle down to work out some interesting technical problem without interruption, save from the everyday worries of a gas manager. This being the case, I propose to abstain from any reference to financial hardships, labour questions, coal control, and the hundred and one other subjects which are dealt with by separate organizations, and to endeavour to concentrate on the side of our work which is technical, and which it is the peculiar province of such an Association as this to consider.

In passing, I may perhaps be permitted to express the opinion, as one intimately connected with the bodies referred to, that any undertaking remaining outside their membership is likely to lose very substantially in a financial sense from its isolated position. I am not referring now to the Federation of Gas Employers, because it may be that very small undertakings can negotiate directly with their own employees, and find it preferable to do so. However this may be, I am most strongly of opinion that the Federation is performing a most useful work; and the advice and assistance which are freely given to members have proved of the utmost value. As regards the National Gas Council, I cannot see any reason for any undertakings to deprive themselves of a right to be heard, and to receive advice and assistance from their neighbours in the district, and from the Central Committee and its efficient staff. Whether it be the price of coke, the rebate on gas, or any administrative matter, the Council is now the authoritative body which deals direct with the Government; and the small amount of the annual subscription is saved many times over in the course of a year.

NEW CARBONIZING PLANT.

The proposed new basis of charging for gas, based on the report of the Fuel Research Board, is bound to have far-reaching effects on the industry; and it is interesting to speculate as to the future trend of invention and development in this connection.

At present the general practice in new carbonizing plant appears largely to favour continuous vertical retorts, with steaming, with which some remarkable results have been achieved where the coal used is suitable. On the other hand, where unscreened Durham coal has to be carbonized, horizontal retorts with stoking machinery seem likely to hold their place for many years to come. Many works have recently added water gas plants, for a variety of reasons, to supplement and dilute the gas produced in inclined or horizontal retorts. It has been stated recently that on a heat-value basis blue water gas is not so cheap to manufacture as coal gas. The reply to this is: "It depends." Compared with a well-equipped installation of horizontal retorts with machinery, I think the contention is generally correct; but where the comparison is with hand-worked horizontals, possibly old but serviceable, the conditions are altogether altered; and it must be remembered that on account of their size many works will continue for the present to be hand-operated. Then there are cases where it is better policy to increase the productive capacity of the works by installing a water-gas plant, rather than to face the heavy capital outlay involved in putting in a new carbonizing plant. The cost of new work in these days is startling; and when one considers the difficulty of raising new capital, and the high rate of interest now expected by investors, it is easy to understand why so many works are following this course. In these days the cost of labour in carbonizing with hand labour may amount to 10d. or 1s. per 1000 c.ft., whereas the labour charges on water gas would be about 2d. or 3d. This makes a difference to the comparative figures. Capital charges should also be included in the costs. A works which has to meet an increasing demand may have two courses open. One, to instal new carbonizing plant costing possibly £40,000, and the other to add a water-gas plant costing, say, £5000 to supplement the existing coal-gas plant. The condition of the latter will probably be the determining factor in the problem; but there are other points to consider—*e.g.*, the low sulphur content of water gas, which relieves the purifiers of a good deal of work. The question of coal conservation, as we all know from the bitter experience of the past few years, must also be taken into account; and I cannot help feeling that there are manifold advantages (apart from the cost per B.Th.U.) of having a plant capable of carbonizing any sort of coal which may be obtainable, and of gasifying part of the coke produced, to eke out the supplies. Such a combination we have in horizontal retorts and separate water-gas plant.

COMPLETE GASIFICATION.

The subject of the complete gasification of coal has recently been attracting a good deal of attention. There are at least two different types of generator originally designed for water-gas manufacture which include a kind of short vertical retort as a charging pouch, and on that account may be used for gasifying coal, in addition to, or in place of, coke. We have recently had descriptions of both types of plant as utilized for water-gas making; and we shall hope to receive information from some of our members of their experiences in complete gasification, as there are now a number of plants of this type in operation in the district. It remains to be seen whether bituminous coal can be successfully gasified in this way, or whether hanging-up of the charge will prove troublesome. Personally, I remain unconvinced when claims for a large make of gas per ton are put forward without other information. It seems at first sight a retrograde step to make no attempt to recover the residuals. I see no reason why ammonia and tar oils should not be recovered. The circulating water becomes very hot, and any ammonia dissolved in it would quickly evaporate, with detrimental results to the surrounding plant; but by covering-in the settling tank, &c., and cooling the circulating liquor, it might be possible to concentrate and recover the ammonia, and the tar oils could be extracted by suitable apparatus as in coal-gas plant. It would also seem necessary to make provision to avoid loss of coal gas resulting from the distilling of the coal during the blow periods, because in the present construction this gas would apparently descend the charging pouch and escape at the stack-valve, instead of travelling upward and passing through the seal in the washer.

It is unsafe to dogmatize on matters of this kind; and, in view of the present high prices of coke, tar, and sulphate, any process which relies on gas only must show by actual figures that the net cost per B.Th.U. delivered to the consumer is markedly lower than with other forms of plant. If this proof can be given we must face the problems involved in distributing a larger volume of low-grade gas; but in my judgment we must know that low-grade gas will provide B.Th.U. at a lower net cost delivered, and that it is generally suitable for distribution not only for water boiling but for use in geysers and circulators, and for all other purposes for which gas is generally used, as well as for incandescent lighting. In giving estimates of the make per ton from plants of this character one would like to see the fuel used for raising steam included, because it is an important item. It has occurred to me that if large quantities of steam were passed upwards through the charging pouch with the hot water gas the yield of ammonia would be largely increased, and results approximating to the Mond process in ammonia yield might be secured, from suitable bituminous coal. The drawback would probably be an increase in the carbon dioxide; but it might pay to purify the gas specially to meet this difficulty to obtain the benefit of the increased ammonia yield.

It really appears that a plant which is primarily designed for water gas manufacture requires some very considerable modification in order to make it suitable for complete gasification; and the plant finally produced must, I think, add some of the features of a coal-gas plant to be thoroughly successful. I see no reason why the ordinary carburetted water-gas plant should not be modified so as to be capable of complete gasification. The present generator need not be altered; but a short length of vertical retort could be erected over it, surrounded by a heating chamber through which the blow gases, and a supply of secondary air from the blower, would pass. Suitable arrangements could be made for connecting the generator to the retort, so that after distillation the coke could be dropped into the generator. Some form of valve would be used between generator and retort, so that the water gas would pass through the coal during the "run," and the valve would be closed during the "blow." It would probably be necessary to use an exhauster to relieve the pressure in the retort; and this would serve to force the gas through condensers, tar extractors and scrubbers, before going to the relief holder. Finally, the waste heat escaping at the stack valve could be utilized to generate the steam required for the plant in a waste-heat boiler. With gas-oil so difficult to procure and so expensive, as it is at present, an alternative plant, which would produce a gas somewhat richer than blue water gas, while at the same time giving a good yield of sulphate, and tar oils suitable for liquid fuel, would be, I am sure, eagerly welcomed. This is the direction in which I expect development to occur—a plant of this type, giving a gas of 375 to 400 B.Th.U. gross, being used as an adjunct to the coal-gas plant, with considerable effect on the conservation of coal, but not displacing altogether the production of coke. It may be that in time all the gas will be made by some such method; but such a radical operation would take years to effect.

HIGH CALORIFIC POWER GAS.

There is another line of inquiry which might profitably be pursued further—viz., the best method of producing and conserving gases of high calorific power. Under the new charter, volume of gas per ton will not have the same importance as of old. With our old method of charging per 1000 c.ft. it was bad policy to make gas of higher value than the legal standard, as the extra therms per thousand produced no revenue; and therefore our efforts were directed to the production of the greatest volume of gas which would pass the prescribed tests. It has always been a bad thing to produce valuable gases, such as methane, in a retort and then to split these up (by high retort temperatures, and prolonged contact with hot surfaces) into carbon and hydrogen. We have had plenty of warnings about this from our scientific advisers in the past. Unfortunately, such well-intended criticism has usually been answered by the assertion that high-temperature carbonization pays, and that the critics could not suggest an alternative method which would be commercially successful. This shows surely a complete misapprehension of the function of science. It is not for the professors to work out technical details, but to supply the guidance we require as to the ideal to be aimed at. Singularly enough practice is now to some extent following theory; and in heavily steamed continuous verticals we have a method of obtaining successful commercial results with a large part of the permanent gases expelled at medium temperatures. In fact, though the coal is finally heated to a high temperature, the distillation is not as a whole what we used to understand by high-temperature carbonization. The practical difficulty is to complete the carbonization of coal in a reasonable time without using high temperatures.

The report by Sir Dugald Clerk and Profs. Smithells and Cobb referred to this subject in their remarks on future development, and suggested internal heating of retorts by passing hot gases through the charge. This subject is of great interest to me, as in November, 1917, I applied for a patent for a method of producing mixed gas by a combined water gas generator and vertical retort; the water gas being superheated by a predetermined amount before passing through a vertical retort, which latter was not to be heated above a certain temperature. The object was not complete gasification of the coal, as a portion of the coke produced was intended to be discharged in the ordinary way. The object was to make it possible to carbonize at medium temperatures and still get a good yield of gas, and a high output per day. I afterwards read Prof. Lewes's "Carbonization of Coal," and saw that he had suggested something very similar; and I am aware that at various times some such plan has been advocated. My thoughts were led in this direction by reading the report of the research work of Prof. Cobb and Mr. Hollings on Thermal Phenomena in Carbonization, which showed that 65 p.ct. of methane was decomposed in passing through a tube packed with coke and heated to 1100° C. I then looked up Dr. Davidson's articles on comparative tests of intermittent verticals and horizontals. In these the analyses of the gases are given as percentages; and my point is brought out more clearly by calculating these as cubic feet per ton. I append some of the figures, together with others taken from reports published by other observers, which I have worked out in the same way.

			Cubic Feet per Ton of Coal.	
			C_nH_m.	CH_4.
Dr. Davidson, "Gas Journal," Volume CXVII., 1912	Derbyshire coal	Verticals, intermittent, unsteamed	280	2920
		" " steamed last two hours	287	2970
		Horizontals, 13 cwt., 12 hours	343	3226
		" 8·67 " 9 "	334	3020
	Yorkshire coal	Verticals, intermittent, unsteamed	426	3400
		" " steamed last two hours	435	3530
J. West, "Gas Journal," Nov. 13, 1917		Verticals, continuous, with steaming	367	3280
		" " without steaming	364	3640
Blundell, "Gas Journal," Oct. 30, 1917		Verticals, continuous, with steaming	356	3516
		" " without steaming	289	2880
Goodall, Clayton, & Co., Booklet on Carbonizing, 1919		Verticals, intermittent, with Settle's downward steaming	538	4775

These figures are not strictly comparative, as the same coal was not used in all the tests; and with regard to the last line, some doubt is thrown on the published figures by the fact that the calculated calorific value from the analysis does not nearly agree with the figure given by the calorimeter, and the percentage of CO appears extraordinarily low considering that a large amount of water gas must be produced in steaming the charge. It would appear that the samples taken for analysis were not representative of the bulk of the gas produced. However, it appears to me that these figures show that further investigation is desirable in the direction of ascertaining which method of working gives the greatest total yield of hydrocarbons and methane.

The above figures refer to one line of possible advance—that is, the protection of valuable hydrocarbons formed in the retort; and there is another line which might repay investigation—viz., the possible manufacture of methane by a synthetic process. Nearly all processes of this nature depend on the action of catalysts, and it may be that some method of producing methane from its elements can also be discovered. In that event, we should have a valuable enricher for bringing up the calorific value of water gas or producer gas.

EXTENSIONS AND REPLACEMENTS OF PLANT.

Turning from speculative remarks to those of a more practical character, I may perhaps enlarge a little on a topic touched on in the first part of this address. I refer to the question of extensions and replacement of plant. Although I argued that in many cases it was better policy to put in supplementary water-gas plant rather than to spend a large amount of capital on a new carbonizing system, I do not wish to be misunderstood. I assumed, of course, that the plant already installed was sufficiently modern and in good enough condition to enable economical results to be achieved—otherwise, most certainly bring it up-to-date or scrap it. No one realizes more keenly than I do the tremendous loss incurred by adopting the policy of "making things do." This is a policy which would soon be fatal on a large works; and I often feel that to run a small works successfully requires the exercise of more ingenuity, and certainly entails more worry and work, than to handle a large plant, because in many cases the money for efficient plant is lacking. Many a harassed gas manager will bear me out in this. Insufficient storage accommodation, purifying and scrubbing area, boiler power, &c., make what should be a well-ordered, smoothly-running plant into a nightmare of terrors. I think of one works where the holders used to be within a few inches of grounding every night in the year, where the belts flew off the exhausters, the seals all blew regularly, and, with regard to the quality of the gas, "of two things one" (as a certain journalist would say)—either the hydraulics got such a heavy seal that the gas was too rich to burn, or they unsealed altogether, and the unhappy foreman spent his nights carrying water in pails up a ladder (to save the expense of a tank) to get them sealed again. The works is now a different place; and though some money had to be spent it has been saved hundreds of times over. So it is with regard to improvements generally. Costs of new plant and difficulties with regard to capital prompt some people to defer the question.

It must, however, not be forgotten that coal and wages having risen so enormously, the savings which can be effected are so much greater now than in pre-war days that the extra capital cost is justified. The extra value of residuals also makes it well worth while to replace inefficient plant for the sake of the savings effected. In fact, the position can be stated in this way—that in these days of expensive coal and high labour costs, only those undertakings will be able to survive which adopt the most improved methods possible; or, to paraphrase an old song, they must either "Get on or go under."

THE DIFFICULTY OF THE SMALL WORKS.

The small works are anxiously looking for some means of improving their position, which is at present very difficult indeed. Steaming of the charges in horizontals does not appear to make much headway, and personally I have always felt that in order to produce good water gas a specially designed cupola is a necessity. In the case of a small works, however, the difficulty of introducing a water-gas plant of the ordinary type militates against its adoption. A plant is required which can be fixed in the retort-house delivering its gas continuously into the foul main, so dispensing with a relief holder. Such a plant must be low in first cost, and in maintenance and attendance charges, and should have the minimum amount of running machinery. A further desideratum is power-operated charging and drawing machinery for small works. Obviously the highly efficient charging and pushing machines suitable for larger works are not adapted for single-ended retorts; and the capital cost of machines with the necessary coal elevator and hopper put them out of court. It should not pass the wit of our inventors to devise simple machinery that would be suitable, and there is a great field for it. It is difficult with single-ended retorts to obtain the full economy of heavy charges because of the space that must be left above the charge for the rake. In many cases, however, a mouthpiece could be put on the back end so as to allow the charge to be pushed out through an opening in the retort-house wall, into the coke yard, and I suggest that in new installations this possibility should be borne in mind. If 12-hour charges could be adopted it would be possible to work the retort-house with two 8-hour shifts, and a moderate-priced machine would in this case soon pay for itself. I do not think we should rest content with a system which involves so much labour for the handling of a small tonnage of coal and coke as is involved in the small works at the present day. When one considers the shovelling and wheeling and opening and closing of lids involved in drawing one retort—and charging it—even with the aid of manual machines—it must, I think, be evident that the necessity which is the mother of invention is in existence, and that if we cannot continue to work efficiently on the old lines something better will have to be evolved. I am not pessimistic about the matter, or about the position of the industry as a whole, believing as I do that when a want exists some means is always found of filling it.

In the case of my Company reconstruction in a root-and-branch fashion has been required for some years, but had to be postponed on account of the war. I had the responsibility of advising my Board as to an entirely new carbonizing plant with coal and coke handling machinery; and we are now putting in horizontals and stoking machinery. The question of coal was the determining factor in the decision. The new retort-house will be the only one worked, so that if we had adopted verticals we could not have picked out the rough coal for them, giving the slack to the horizontals, as can be done on a larger works with two or three retort-houses at work. I had to face the fact that the new plant would be working on unscreened Durham coal one day and York-

shire coal the next; and I decided that under these conditions horizontals were more suitable.

THE POSITION OF "GAS ENGINEERS."

At our last meeting Sir Arthur Duckham expressed his conviction that the Institution of Gas Engineers should open its doors to the engineers who build—and very largely design—the plant we use. He pointed out that more and more of the designing is being done by the contractors, and that being so we ought to get together and exchange views. When one considers the developments in the magnitude and complexity of gas-works plant, the alteration in the direction he mentions must appear inevitable. Specialization is the order of the day, and the contracting firms are specialists, with a wider knowledge of their own particular section than any gas engineer and manager can possibly possess. This does not imply that the professional gas engineer's advice is unnecessary. On the contrary, he has to select the type of plant suitable, and have the standard design modified to suit his views, and to fit his works and method of working; and he has further to design his scheme as a whole, and probably to carry out himself the construction of various parts of it. However, we do, I think, recognize and appreciate the splendid work which has been done by the makers of plant, and the skill and knowledge which they have brought to bear on the problems of design and construction. Let us, therefore, admit their right to be called gas engineers, and welcome any opportunity of conferring with them as equals in every way.

Personally, I would like to go further, and arrange for opportunities to be given for the exchange of our junior staffs, so that every engineering designer and draughtsman would serve for a time on a gas-works, actually working the type of plant he afterwards has to put on paper; and every aspiring gas manager should similarly gain an insight into the design and manufacture of the plant he will afterwards be called upon to handle. The lack of this co-operation is often felt in practice. I think it is the general experience to find that contractor-designed plant has to be altered and generally simplified and improved by the gas-works staff after being set to work. Some of the improvements come to the attention of the contractors, and are afterwards embodied in the designs, and thus in course of time accumulated experience and the brains of many men produce a piece of apparatus which is as nearly as possible perfect. My point is that in reaching that position much time is lost, and money wasted, which might have been saved had both sides had a fuller knowledge of the conditions of the other. In this connection I would like to urge the importance of giving to our juniors proper status and remuneration in keeping with their responsibilities and skill. The old days of simple apparatus and unskilled labour have gone beyond recall; and an assistant, competent to grapple with the chemical and mechanical problems of a modern works, must be a skilled engineer, and should be treated accordingly.

DEPRECIATION.

Every well-managed undertaking writes-off depreciation on such things as meters and stoves charged to capital; and in view of the present day cost of these articles it is more than ever necessary to reduce the heavy capital burden and to provide against the wasting of these assets. I do not know whether it is generally realized that depreciation can be claimed for income-tax purposes on meters, stoves, and gasholders at certain rates, which have recently been increased to 15 p.ct. on meters and stoves and 4½ p.ct. on gasholders, whether the depreciation has been written-off in the revenue account or not. I recommend any member who has not done so to carefully consider the agreed scheme (dated September, 1912)* which allows depreciation to be written-off in the computation of income-tax, although in this case renewals have to be charged to capital. No doubt all undertakings will claim the allowance to which they are entitled under section 18 Finance Act, 1919, for depreciation on certain gas-works buildings, which concession has been obtained through the efforts of the Gas Companies' Protection Association. Another matter to which it may be useful to direct attention is the question of fire and boiler insurance. I think it is obvious that the original cost of the plant is no criterion of the replacement value, and that the old policies require to be increased so that the property is covered in such sums as will allow any damaged plant or buildings to be replaced at present-day costs. Those who have not recently had occasion to invite tenders for new plant must be somewhat at a loss in estimating costs at present. All the old handbooks are hopelessly out of date in this respect; and there is a great need for a new Price Book, which should base the costs on percentages, with steel, labour, &c., at certain prices, so that by taking current prices one could correct accordingly.

IN CONCLUSION.

I trust I have not wearied you with this somewhat lengthy address, and that, however much you may disagree with my views, I have had the good fortune to give you some food for reflection. In conclusion, perhaps you will allow me to say that, in my view, our Association has reason to be proud of its long record and the position it now occupies. I believe that the members generally are anxious to maintain the prestige of the Eastern Counties Association; and the ideal we should aim at is to have less than 12 p.ct. of "inert constituents" in our ranks, whatever may be our views as to the amount suitable for distribution in the gas we supply. Only by the united efforts of our members can we hope to face and master the difficulties which confront us, and to advance the great work of the industry to which we are proud to belong.

* See "JOURNAL," Sept. 24, 1912, p. 830.

At the close of the address,

Mr. J. R. BRADSHAW (Retford) said it fell to his lot to propose a hearty vote of thanks to the President for his admirable address. It left him almost speechless. The ground the President had covered was very wide; and he had given them a tremendous lot of information—both of a theoretical and practical nature. All the good things that were said about Mr. Townsend at the luncheon were confirmed by the address he had delivered.

Mr. E. W. SMITH (Chelmsford), in seconding, said he felt sure they would listen to an interesting and instructive address at this meeting; and they had done so. It was a pity that such an address was not open for discussion. It bristled with useful information, and certainly contained much food for reflection.

Mr. R. G. Shadbolt (Grantham) supported the motion. He remarked that Mr. Townsend might be looked upon as one of the most active-minded Presidents in the gas industry. He had portrayed himself in the address he had delivered. It covered a multitude of questions in a very courageous manner; and it was typical of himself. The address displayed, to his (Mr. Shadbolt's) mind, this one fact, that their President was a very live gas engineer; but he was in a mentally transition stage at the present moment, as most of them who had to think about these things found themselves. He (Mr. Shadbolt) would deprecate any attempt to depart from the customary practice in this matter by beginning to discuss the address. So far as they had gone as an Association, they had always understood that the President's address was free from criticism for the time being.

The motion was cordially carried.

The PRESIDENT thanked the three speakers very heartily for the way they had spoken, and for the manner in which the members had received the motion. It had been a pleasant surprise to him. The address, he confessed, had had an amount of pot-boiling. He started writing it last October. Before he had finished it, in the last few weeks a number of people were writing about complete gasification and various other things; and some of these things were identical with the matters he had dealt with. However, he determined to let them stand. It was no use making eleventh-hour alterations. As to discussing the address, he should be very pleased to have it thrown-open for discussion at a subsequent meeting. He was quite prepared to answer for anything he had said. He was also perfectly prepared to hear there were a number of people with entirely different views; and he should be interested to hear what they were. At any rate, the address presented a few points for future reference, and he hoped that they might get some problems elucidated which were troubling them at the present time.

DISTRIBUTION OF GAS TO OUTLYING VILLAGES.

A paper was next read by Mr. A. W. SUMNER (Grays) on the above subject. This appears elsewhere in this issue. The discussion will be reported next week.

ELECTION OF OFFICE-BEARERS.

Mr. F. PRENTICE (Ipswich) moved the election of Mr. Sumner as President for the ensuing year. He observed that while he did not envy the man who had to follow Mr. Townsend in the Presidential Chair, he thought that in Mr. Sumner the members had an exceedingly good man for the position. This was evidenced by the paper he had read, together with the map and photographs he had submitted, as well as by the way he had answered the questions addressed to him. He was evidently a man of courage, skill, and resource; and he thought the members were fortunate in having him in this position.

Mr. GRIMWOOD seconded the motion, which was cordially passed.

Mr. SUMNER thanked the members for the honour done him. He should do his best during his term of office; and, if he failed, he hoped the members would forgive him.

Mr. J. H. TROUGHTON (Newmarket) proposed that Mr. H. G. Ruggles, of Leighton Buzzard, be the new Vice-President. The name of Ruggles always appealed to members of the Eastern Counties Association.

Mr. J. W. AUCHTERLONIE (Cambridge), in seconding, said they all remembered Mr. Ruggles' genial father. They had had Mr. Wimhurst follow his father in the Presidential Chair of the Association; and they would have Mr. Ruggles doing the same thing. He was sure the members would, when the time came, give Mr. Ruggles a most hearty welcome.

Mr. RUGGLES thanked the members for the honour they had conferred upon him. He should do his utmost to carry out the work of the Association in a manner which would reflect credit upon their choice.

Mr. G. R. CASTERTON (Melton Mowbray) proposed that Mr. F. A. West, of Newark, and Mr. T. F. Canning, of Southend, be elected members of the Committee.

Mr. E. F. KEABLE (Southtown) seconded the motion, which was carried unanimously.

NEW HON. SECRETARY AND TREASURER.

The PRESIDENT said the members owed a great debt of gratitude to Mr. Paternoster, who had carried on the work of Hon. Secretary and Treasurer for six years—through the period of war, and while he had so many affairs of his own to which to attend.

During the last twelve months, he had been far from well; and it was with great self-sacrifice that he had carried on the work of the Association. He had had to give way now under the doctor's orders; and so he could not finish the arrangements for this meeting. Mr. Wimhurst, of Bury St. Edmunds, had stepped into the breach, and had carried out the arrangements in an admirable manner.

Mr. E. G. SMITHARD (King's Lynn) said before proposing the name of the new Hon. Secretary and Treasurer, he should like to supplement the President's remarks with regard to their highly respected Secretary and Treasurer. He believed this was the first meeting from which Mr. Paternoster had been absent since he became Hon. Secretary and Treasurer. He had contributed several papers to their proceedings, and was one of the Past-Presidents. They all regretted exceedingly that he was unable to be with them, and especially so in view of the cause. The members wished him a speedy recovery, and hoped to see him among them again at their next meeting in a much improved state of health. He had now very much pleasure in proposing that Mr. W. H. Mainwaring, of Lincoln, be appointed to succeed Mr. Paternoster. He was well known to the members, and had taken an active interest in the work of the Association since he came among them. He would certainly make an able successor to Mr. Paternoster.

Mr. MALLETT seconded the motion, remarking that the members ought to congratulate themselves on having secured a gentleman like Mr. Mainwaring to take up these duties. He would be an indefatigable Secretary, and a worthy successor to Mr. Paternoster; and the interests of the Association would be safe in his hands.

Mr. MAINWARING said he should have great pleasure in endeavouring to do the work, although no one was more sorry than he was over the cause.

On the motion of Mr. RUGGLES, seconded by Mr. C. J. ROBINSON (Walton-on-the-Naze), Mr. W. Beale, of Royston, and Mr. G. A. Mallett, of Ipswich, were appointed Auditors.

PLACE OF NEXT MEETING.

It was decided to leave to the Committee the selection of the place for the next meeting.

NATIONAL ASSOCIATION OF TECHNICAL GAS OFFICIALS.

At this stage tea was served; and afterwards there was a sitting to hear a statement by Dr. E. W. SMITH (Birmingham) as to the National Association of Technical Gas Officials. The objects of the Association were fully explained; and the general feeling was one of sympathy for them. This was expressed not only by speech but by a vote, in connection with which, while some members did not take part, there was not a single hostile hand seen. A Committee was appointed to go further into the matter from the district point of view.

DINNER.

In the evening, the members dined together at the George Hotel, with the PRESIDENT in the chair. Alderman W. Gurney Benham, the Chairman of the Gas Company, and some of his directorial colleagues, with various other local gentlemen, were present as guests of the Association. The toast of "The King" was duly honoured; and then Mr. W. CRANFIELD proposed "The Eastern Counties Gas Managers' Association." He expressed his pleasure in submitting the toast, and spoke of the excellence of the Association. But he could have wished that the duty of proposing the toast had been committed to the President's worthy father. This would have made these proceedings complete. He had had the privilege of many years' acquaintance with Mr. Townsend, sen., as well as with his sons. And he knew what an admirable father and professional man Mr. Harry Townsend was. This would have been one of the gladdest days of his career to have seen his honoured son occupying this honoured place. The PRESIDENT thanked Mr. Cranfield most sincerely for the way in which he had proposed the toast. He also thanked him for his reference to his father. His father did intend to be present at the meeting; but he sent a letter of regret, at the same time mentioning that he thought a father was better absent from a meeting on such an occasion. As to the Association, they had had a pleasant meeting; and he wished to express his indebtedness to Mr. Wimhurst for all he had done, as well as to the President-elect. He further expressed his pleasure in seeing so many visitors present, including the local gentlemen. The toast of "The Town and Trade of Colchester" was proposed by Mr. R. G. SHADBOLT in an eloquent and amusing speech, in which he referred to the historical associations of the ancient borough, and to its modern developments. Alderman GURNEY BENHAM responded in a speech which was received with much laughter and applause. Mr. A. W. SUMNER proposed the toast of "Kindred Associations," which was replied to by Mr. W. E. PRICE. Major TUFNELL, the Deputy-Chairman of the Gas Company, wound-up the proceedings by proposing the health of the President in most complimentary terms, thanking him for the admirable arrangements made for the meeting, and expressing the confidence of the Board in him as their General Manager. The toast was accorded with musical honours; and the dinner concluded with the singing of the National Anthem.

VISIT TO THE GAS-WORKS AND PLACES OF HISTORIC INTEREST.

Many of the members and friends stayed over to the next morning, in order to visit the gas-works, and to make a brief tour of the Castle and to see other objects of interest. The programme was taken in hand early; and by 9.30 some of the visitors were on their way to the gas-works, where they were met by the President and his assistant, Mr. M. L. Smith. What was seen was told with admirable brevity and plainness in a little descriptive pamphlet that was distributed among the members. From this we take the following particulars:

Gas was first introduced in Colchester as far back as 1819; and the works on the present site adjoining the River Colne were begun in 1838. The present output is 250 millions per annum.

The retort-house, direct-fired and containing twenty single settings of seven retorts, the engine-house, and some of the older buildings, were built in 1876 by the late Mr. G. Ernest Stevenson.

Coal is unloaded by hydraulic crane at the wharf into narrow-gauge wagons, crosses the yard, and is elevated into a covered store of some 4500 tons capacity.

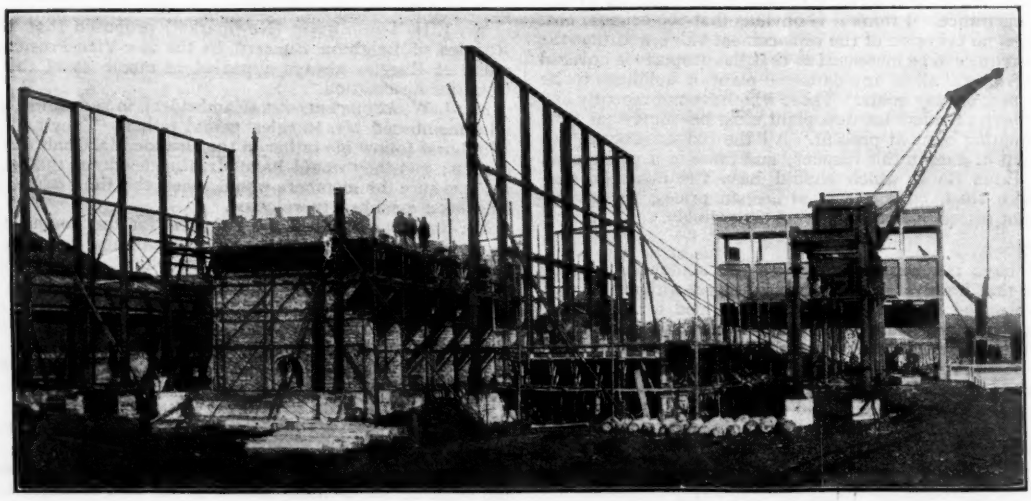
The water used on the works is pumped from a borehole 300 ft. deep, and is stored in a cast-iron tank above the pump-house.

There is an installation of two water gas sets by Davison and Partner, each of a capacity of half-a-million per day. The relief holder for the water gas has a capacity of 90,000 c.ft., the two main holders being of 420,000 c.ft. and 431,000 c.ft. capacity respectively.

[It will be of interest to "JOURNAL" readers to recall Mr. Townsend's paper, read before the Eastern Counties Gas Managers' Association on May 1, 1919, on "Water Gas Plant at Colchester." This was reported in the "JOURNAL," Vol. CXLVI., No. 2921.]

A large amount of plant in course of construction claimed special attention and interest.

A coal breaker pit is being constructed in reinforced concrete and surrounded by clay puddle externally, the pit being below high-water level in the river and the ground full of water. There will be a hopper capable of holding a truck load of coal below the railway metals which cross the pit, and below this the usual jigging feed, a 30-ton per hour coal breaker, and the elevator boot. The machinery will be belt-driven by an electric motor fixed above ground in the coal store. Two hydraulic wagon-tippers will be fixed below ground for tipping railway trucks into the hopper; so that trucks can be tipped whether the end door is to the right or left. A bucket elevator will raise the coal from the breaker to the top of the gable end of the old coal store, where it will drop it on to a band conveyor 30 ft. in length. This will deposit it in the

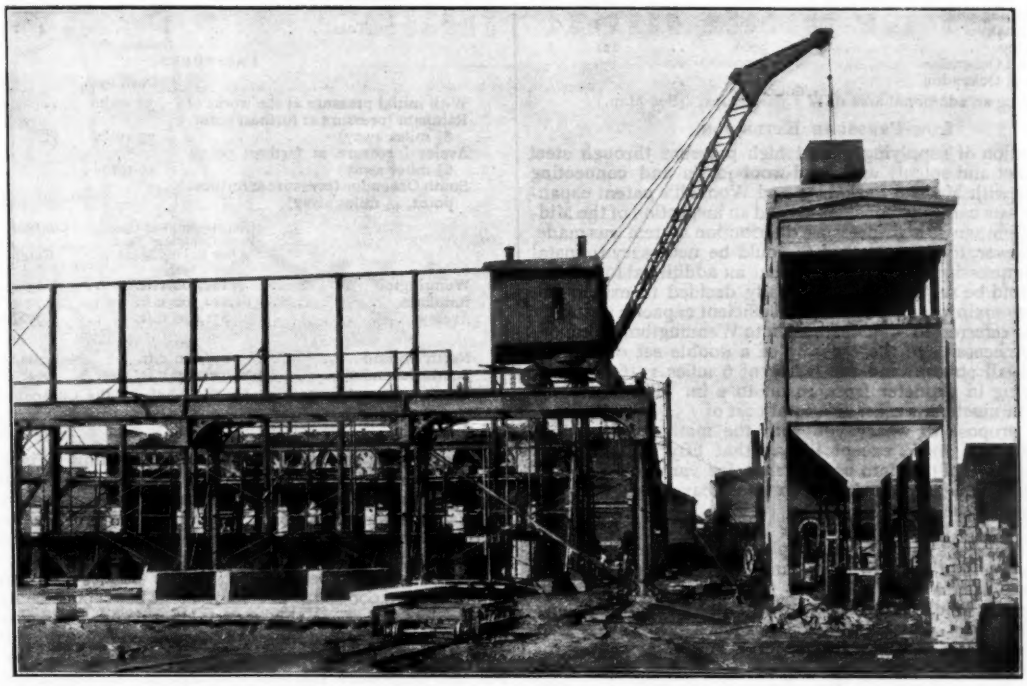


GENERAL VIEW OF THE NEW CONSTRUCTION WORK, WITH THE GIBBONS RETORT-HOUSE IN THE FOREGROUND.

store, 30 ft. in width. In order to save the cost of raising the pitch pine roof of the coal store, the band conveyor will be carried above the apex of the roof and supported by the gantry previously used for coal tubs, the gantry being raised and the columns lengthened for the purpose. Part of the slating has been removed on each side of the apex; and the new construction will be roofed-in over the conveyor and provided with sheeted sides which will act as shoots to guide the coal into the store. From the store the coal will be taken by a long elevator (fed by a rotary filler, so that coke can be piled above the boot) across a narrow roadway to the top of the new horizontal retort-house, where it will be so arranged that it can feed a second conveyor in the case of future extensions as well as the push-plate conveyor for the new house.

The new house is a steel-framed building, 84 ft. long, 63 ft. wide, and 41 ft. wide to the eaves, filled in with brickwork. The charging floor is 23 ft. wide so as to give plenty of room for the machine; and the discharging stage is 18 ft. wide. In this six arches have been constructed to take eight retorts each set in two vertical rows. The retorts are flat sided Ω, 24 in. by 16 in. by 22 ft. in length. The contract for the whole of the retort-house and coal-handling plant has been let to Gibbons Bros.; and a Guest-Gibbons machine will be installed.

The principal features of interest about this part of the plant are (1) the projecting furnaces with large feeding doors, so as to allow the coke to be pushed into them easily from the retorts; (2) ascension pipes at both ends, fitted with Cort's anti-dip valves; and (3) the foundations, which are of reinforced concrete resting on 69 reinforced concrete piles, some of which were driven to a depth of 31 ft. (4) The coke-handling arrangements. Outside the retort house, on the discharging side, a line of coke-bunkers is being constructed in length the same as the retort-bench, in width 20 ft., and in depth sufficient to make the top level with the floor of the discharging stage. The coke



CRANE GANTRY CONSTRUCTED BY THE COMPANY AND THE GORDON-HARVEY SCREENING PLANT AND HOPPERS.

will be pushed into coke wagons running on 2-ft. gauge lines, across the discharging stage, which is given a slope outward, so that the wagon with its charge of hot coke will run out over the hoppers by gravity. The contents of the wagons will, after being doused by a spray of water, be dumped direct into the low-level bunkers, where the quenching will be completed by the retort-house men from the discharging floor. A crane gantry constructed by the Company runs parallel to the line of bunkers; and on this is mounted a 3-ton steam crane. The coke stored in the bunkers at night and at week ends will be dropped from them into skips mounted on roller-bearing trollies, which will run under the bunkers. These will be run-out clear of the bunkers and picked-up by the crane. The crane can pile the coke alongside the gantry, if stocking is necessary, or can shoot its load into the overhead feeding hopper of the screening plant in ton lots. The screening plant and hoppers are by the Gordon Harvey Company. The coke is fed to the screen (of the rotary pattern) by a jigging feed, which also separates the large coke immediately, and leaves only the breeze and small to pass through the long rotary screen. The various sizes are stored up to a total of 60 tons, in all, in various compartments of the overhead reinforced concrete hoppers, resting on 16 in. octagonal reinforced concrete piles. These hoppers are designed to feed railway wagons at one side, motor wagons and carts in the centre, and bagging shoots at a platform on the other side. The crane is intended to take surplus breeze from the hoppers and pile it in the open yard, and also to deposit the various sizes of small breeze (after screening) in the washery hopper which it is intended to add.

The whole of the new plant is on a new site adjoining the old works, and so arranged as to give good siding accommodation, plenty of room for coke storage, and to allow of the plant being trebled in size by simply adding fresh units. The existing plant has not been interfered with, and can remain at work till the new is finished. The new plant, except the crane, is all electrically operated; and an old purifying house next to the boiler plant has been cleared-out and utilized as a generating station. In this a hand crane has been erected; and duplicate generators by Crompton and Co., of Chelmsford, are in course of erection, each of 36-kw. capacity.

In his pamphlet Mr. Townsend makes no reference to the new stokers' lobby which he is constructing with the help of a Wingate machine. The ground floor is complete and installed with two luxurious baths and three lavatory basins.

The visit concluded with an inspection of the working drawings of the original and the new plant, and some interesting and significant figures as to the cost of work of this kind nowadays.

That he is able to supervise and carry-out so great a quantity of new construction, and at the same time maintain his works in such a state of efficiency and cleanliness, must be a matter of considerable congratulation to Mr. Townsend.

Matters of Historic Interest.

On leaving the works, the party, which numbered about forty, was conveyed by tram to High Street, where a very interesting but all too short tour of some of Colchester's treasures was commenced. Many buildings of ancient and historic interest, in all of which tiles and bricks of Roman manufacture were evident, were passed *en route* to the Castle. These and, later, the thousand-and-one points of interest brought up during the inspection of the unique Roman collection and Norman ruin at the Castle were admirably enlarged on by Mr. Gurney Benham, whose knowledge of such matters is extensive and well known. We cannot close the report without mentioning that, in St. Peter's Church, forty gas engineers did homage at the tablet which commemorates the life and work of William Gilberd, 1540-1603, the pioneer of electrical research. All the visitors realized the great indebtedness they were under to Mr. Gurney Benham for his courtesy in imparting so much interest to them during the morning's tour; and he was heartily thanked for his kindness.

There was no official luncheon, as the majority of members had to leave by early trains.

Coke Oven Managers' Association (Midland Section).—Owing to the indisposition of the President (Mr. J. W. Lee), it was necessary to cancel the visit of the members that had been arranged for Saturday last to Chesterfield.

Temporary Increase of Charges Act.—The Ministry of Health have issued an Order, under the Statutory Undertakings (Temporary Increase of Charges) Act, authorizing the Brighouse Corporation to increase the maximum price of gas from 4s. to 6s. per 1000 c.ft., subject to rebate.

Peat for Gas Production.—Mr. Noel F. Harrison, an engineer of wide experience in gas power development in America, proposes to visit Ireland this year with the object of interesting municipal and other authorities in the question of developing the Irish peat bogs. He points out that producer gas plant designed for gasifying peat for use in gas-engines of high power has been in successful operation in Italy, Sweden, Russia, &c., while the United States and Canada are actively moving in the matter. He urges that Ireland, with such immense bog areas of the finest peat in the world, should reap the advantage of power production for lighting and other purposes.

THE DISTRIBUTION OF GAS TO OUTLYING VILLAGES.

By Arthur W. Sumner, of Grays.

[A Paper read before the Eastern Counties Gas Managers' Association at Colchester, April 21.]

During the past few months attention has been drawn to the Government's projected scheme of generating electricity by means of super-stations, and supplying light and power, not only to large centres, but also embracing in the scheme the smaller towns and country villages. Our Technical Press has also on several occasions submitted that gas companies might emulate the proposal, and extend their limits of supply to neighbouring parishes, and thus forestall their competitors. The writer, therefore, ventures to hope that what has been done in this direction by his Company, although on only a small scale, may prove of interest to those who may at some future time consider the question of linking-up outlying districts.

Area of Supply.

The Company's area of supply up to 1906 consisted of a group of small parishes covering approximately 18 square miles; the make of gas for that year being 69,530,000 c.ft. In 1907 parliamentary powers were obtained to extend the gas-mains to the following parishes:

Parish.	Length of Main in Yards.	Number of Houses.
Wennington } Rainham }	8616	369
Aveley	3060	221
South Ockendon	9000	330
North Ockendon	—	—

Adding an additional area of 14 square miles. [See Map.]

Low-Pressure Extension.

The question of supplying gas at high pressure through steel mains (socket and spigot) with lead-wool joints and connecting the services with Messrs. Parkinson and Woodall's patent expansion nipple was carefully considered; and an inspection of the Mid-Kent Gas Company's high-pressure distribution system was made. Owing, however, to the fact that it would be necessary to instal suitable compressing plant, and also that an additional four miles of main would be required, it was finally decided to extend the low-pressure main which was then of sufficient capacity to supply the districts referred to. The extension to Wennington, Rainham, and Aveley necessitated the crossing of a double set of railway metals, a small stream, and the laying of 6 miles 1116 yards of mains varying in diameter from 10 in. to 2 in. The work was completed in nineteen weeks, at a total cost of £5254.

I do not propose to weary you with the method adopted in carrying out this work, except to say that fifty to sixty men were employed—split-up into useful gangs for various jobs. All the work was done "day work," except the excavating, which was let to a gang "piece-work."

In order to save the heavy hammer and clink work, a steam-roller with scarifier attached was employed, which removed the top granite to a depth of 9 to 10 in., and when not employed on this work was used for repairing the trench opened previously. In this way, the whole job went with a swing—the road being kept tidy and safe. In addition a blacksmith was engaged to repair picks, chisels, &c., a portable forge and anvil being provided. During the time the main work was proceeding, fitters were employed fitting-up houses in the villages which had previously been canvassed; so that, as the main was laid, services were connected, and revenue earned.

The extension to Ockendon was carried out in a similar manner the following year. In this instance, 5 miles 201 yards of main varying in size from 8 in. to 3 in. were laid at a cost of £2570. Details regarding the above work are given.

Further Extensions.

Early in the year 1912 the question again arose regarding a further extension of the Company's area. The new proposal had for its object that of acquiring four small works, and incidentally linking-up a number of villages not having a supply of gas. This scheme included forty-one parishes, and comprised an additional area of approximately 130 square miles. The works were:

	Annual Sale of Gas, 1912.
1. Stanford-le-Hope	5,861,000 c.ft.
2. Laindon	1,208,400 c.ft.
3. Billericay	4,934,300 c.ft.
4. Rayleigh	5,462,900 c.ft.

Acting upon instructions, a survey and report were made upon the works and district concerned. The method adopted was to go through the whole of the area—a detailed account of the number and class of houses, shops, public houses, churches, schools, public lighting, &c., being noted, and estimates prepared regarding the quantity of gas likely to be required, the routes to be taken when laying the mains, and the general probabilities and possibilities of the district, having due regard to future developments. This work was carefully carried out; conservative estimates regarding the probable consumption and cost being made, based upon experience gained when carrying out the 1907 extension.

Aveley and Rainham Extension.

	10-in.	8-in.	6-in.	4-in.	3in.	2in.
Size of main, length in yards	6378	523	1347	1980	1439	6
Total cost per yard, including pipe, labour, &c.	12/2½	7/9	6/1¾	4/3¾	3/1¼	

Cost of Laying Main.

	£	s.	d.
Cost of pipes used	3659	12	0
Specials for River Mardyke	32	15	6
Lead	267	7	11
Tools	7	15	5
Timber	1	10	0
Yarn	23	5	9
Castings and syphons	71	19	8
Cartage	155	5	6
Coke and coal used	11	14	10
Labour	1023	5	11
Total	5254	12	6

Ockendon Extension.

	10-in.	8-in.	6-in.	4-in.	3-in.
Size of main, length in yards	44	356	7120	743	738

Cost of Laying Main.

	£	s.	d.
Pipes	1704	12	4
Specials for River Mardyke	7	12	6
Lead	108	13	0
Tools and timber	2	10	0
Yarn	7	1	11
Castings and syphons	42	15	2
Cartage	51	9	11
Coal and coke	8	1	0
Labour	637	8	3
Total	2570	4	1

Pressures.

	Dec., 1907.	July, 1908.
With initial pressure at the works of	30-10ths	27-10ths
Rainham (pressure at furthest point, 8¼ miles away)	25-10ths	—
Aveley (pressure at farthest point, 6¼ miles away)	35-10ths	—
South Ockendon (pressure at furthest point, 4½ miles away)	—	23-10ths

	Consumption of Gas, First Complete Year After Laying Main. 1908.	Consumption of Gas, Last Complete Year. 1919.
Wennington	124,500 c.ft.	433,500 c.ft.
Rainham	1,222,300 c.ft.	4,702,800 c.ft.
Aveley	871,120 c.ft.	1,956,700 c.ft.
	1909.	
North Stifford	255,600 c.ft.	1,392,600 c.ft.
South Ockendon	726,917 c.ft.	1,948,500 c.ft.

The total make of gas in 1912 for the whole of the Company's area was 87,817,000 c.ft.

It had been previously found when extending to new districts that approximately 65 p.ct. of the householders would take a supply of gas without undue influence on the part of the Company's representative. But in making the above estimate only 50 p.ct. were counted upon. The consumption per consumer was put at: Ordinary consumers, 20,000 c.ft. per annum; slot consumers, 8000 c.ft. per annum; public houses and large establishments, 40,000 c.ft. per annum. The report contained the proposal to purchase the undertakings; and, after closing them down, to manufacture the gas at Grays, and distribute it through high-pressure mains to the various centres and villages *en route*. For this purpose, a Bill was promoted in Parliament and received the Royal Assent in August, 1913.

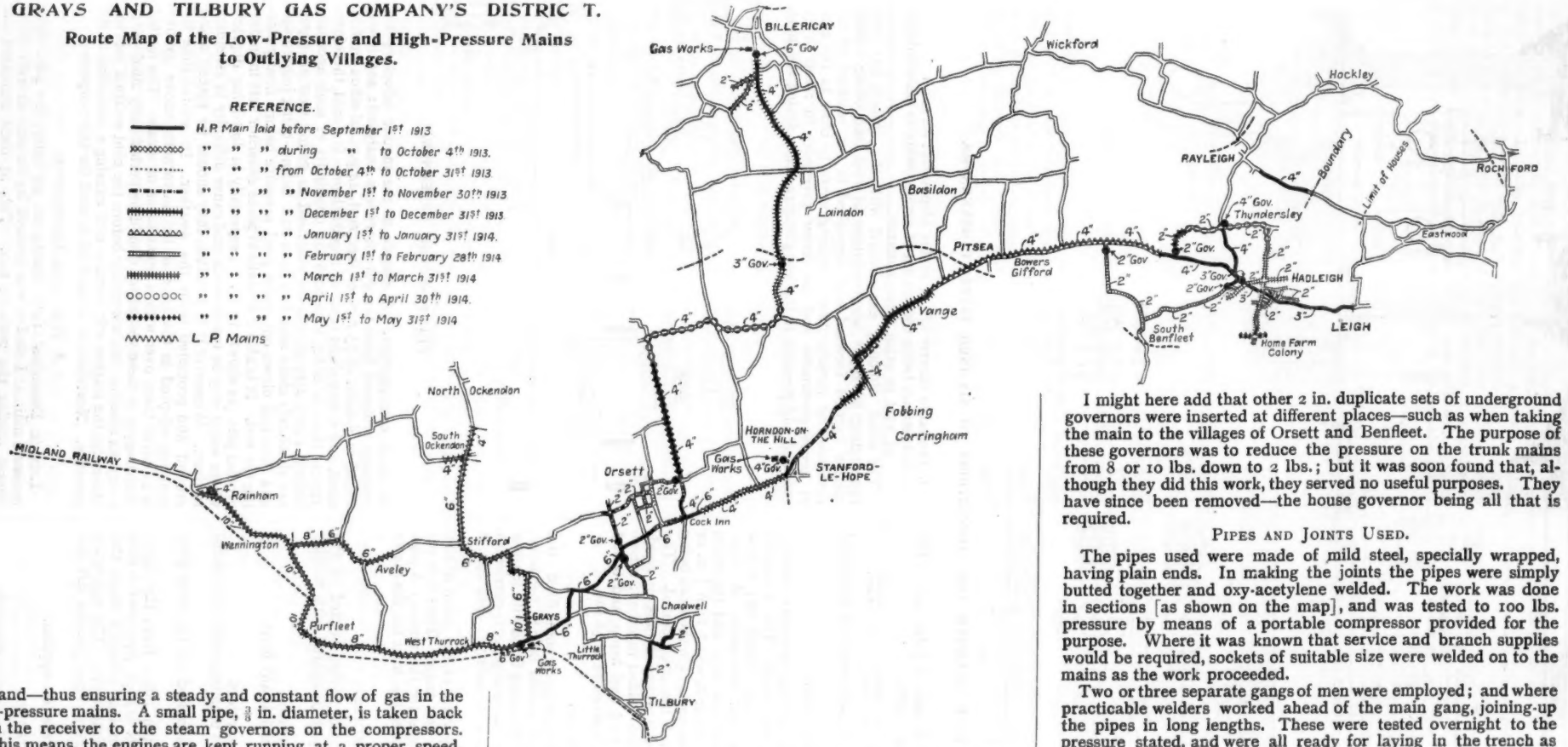
It should be stated that the work was actually commenced by agreement with the owner of the Rayleigh Gas-Works in that particular district, in the late autumn of 1912; the mains laid for high pressure being extended from Rayleigh to Hadleigh [see map], and the gas supplied from Rayleigh being raised to 15 or 16 inches pressure by using a small exhauster provided for the purpose. Subsequently the whole job was let to the Helm Lamp Company—now Gas Distribution, Ltd., of Nuneaton. This Company supplied the necessary plant, mains, &c., and carried out the entire work.

Description of the High-Pressure Scheme.

With the aid of the map it will be possible to follow the order in which the work was proceeded with, and also the lengths and sizes of the mains used. At the works at Grays two Ingersoll-Rand gas compressors were installed, each capable of compressing 25,000 c.ft. of gas per hour to 100 lbs. pressure. The compressors receive a supply of gas taken from the outlet mains (18 in. diameter) of two gasholders, through a 10 in. pipe which first enters a boiler shell, 11 ft. by 4 ft. 6 in., to prevent excessive oscillation. The inlet and outlet of the compressors are of 4 in. diameter; and the gas is raised from 6½ in. to 25 lbs. pressure—being discharged into a 6-in. steel main and emptying into a receiver (another boiler shell) of 1200 c.ft. capacity. The 6 in. pipe passes through the centre of the receiver to within a few feet of the far end, and thus protects the main from the direct hammer-like blow which occurs in the receiver at each stroke of the engine. The outlet main from the receiver is 6 in. diameter, taken off the front of the shell at a lower level, to a duplicate set of 6 in. high-pressure governors, which reduce the gas pressure to 10 lbs. This is increased to 15 lbs. at night or periods of heavy

GRAYS AND TILBURY GAS COMPANY'S DISTRICT.

Route Map of the Low-Pressure and High-Pressure Mains to Outlying Villages.



demand—thus ensuring a steady and constant flow of gas in the high-pressure mains. A small pipe, ¾ in. diameter, is taken back from the receiver to the steam governors on the compressors. By this means, the engines are kept running at a proper speed, increasing or slowing-up according to the demand for gas, and ensuring a constant 25 lbs. pressure in the receiver for the whole of each twenty-four hours. A set of gauges records the pressures at the receiver and outlet of the governors.

Mains.

From the outlet of the governors a 6 in. diameter steel main carries the gas for a distance of four miles, at which point it is reduced to 4 in. diameter, and branches-off in two directions—one along the main Southend Road, passing through Stanford-le-Hope and on to Rayleigh, and the other away to the north over Laindon Hills (400 ft. in height) and on to Billericay. Smaller mains of suitable sizes are taken off for the supply of villages and side streets *en route*. At every 1000 yards valves are inserted for use in case of emergency.

In order to pick up the existing low-pressure mains of the old Companies, the following sets of governors (in duplicate) have been provided. [See fig. 1].

Stanford-le-Hope . . .	4 in. governors in underground pit, reducing gas to 4 in. pressure.
Hadleigh	" " " "
Rayleigh	6 in. governors in underground pit, reducing gas to 4 in. pressure.
Laindon	3 in. set in underground pit, reducing gas to 4 in. pressure.
Billericay	6 in. set fixed above ground, on site of old works, reducing to 5 in. pressure.

Every endeavour is made to maintain about 5 lbs. pressure at the inlet of the governors distributing in the various centres. The object of the district governor is to reduce the pressure in two stages—first from pounds to pounds, and second from pounds to inches.

I might here add that other 2 in. duplicate sets of underground governors were inserted at different places—such as when taking the main to the villages of Orsett and Benfleet. The purpose of these governors was to reduce the pressure on the trunk mains from 8 or 10 lbs. down to 2 lbs.; but it was soon found that, although they did this work, they served no useful purposes. They have since been removed—the house governor being all that is required.

Pipes and Joints Used.

The pipes used were made of mild steel, specially wrapped, having plain ends. In making the joints the pipes were simply butted together and oxy-acetylene welded. The work was done in sections [as shown on the map], and was tested to 100 lbs. pressure by means of a portable compressor provided for the purpose. Where it was known that service and branch supplies would be required, sockets of suitable size were welded on to the mains as the work proceeded.

Two or three separate gangs of men were employed; and where practicable welders worked ahead of the main gang, joining-up the pipes in long lengths. These were tested overnight to the pressure stated, and were all ready for laying in the trench as soon as it was prepared. In this way frequently a quarter of a mile of main was laid per day. For protection, the joints were painted with dehydrated tar, and then wrapped with jute dressed with tar.

As previously hinted, the work was not carried out exactly in the order in which it has been described, for the reason that it was desired to close-down the gas-works as early as possible instead of waiting for the completion of the whole scheme. For instance, as soon as the high-pressure main was laid as far as Stanford-le-Hope, a small compressor was set to work to pump gas from Grays. The same method was employed at Billericay—gas being sent from that works to Laindon.

The four gas-works were closed-down on the following dates:

Stanford-le-Hope works closed	Nov. 26, 1913
Laindon " "	Feb. 5, 1914
Rayleigh " "	March 31, 1914
Billericay " "	May 23, 1914

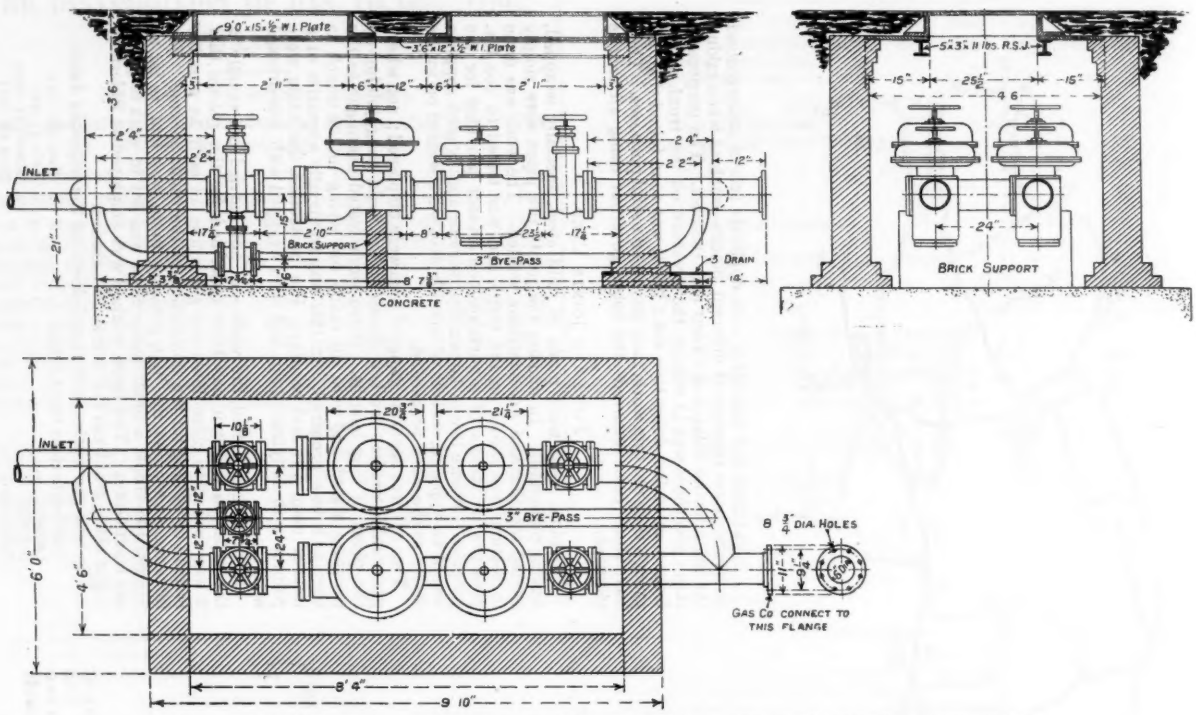


FIG. 1.—PATHWAY TYPE CHAMBER AND CONNECTIONS TO SIX-INCH DISTRICT GOVERNORS.

The whole of the main was laid by the end of July, 1914. The lengths and sizes of mains laid were as under:

Size of main . .	6 in.	4 in.	3 in.	2 in.	1 in.	Total
Length in yards .	6820	41,864	1816	28,038	351	78,889

The cost, including compressor, receiver, and governors, amounted to £24,645.

SERVICE CONNECTIONS.

In making a service connection with the high-pressure main, a Helps's patent clip of suitable size was used. The wrapping on the main is first removed and the clip bolted on; a lead strip being placed between the clip and the main. A high-pressure gas-cock is then screwed into the clip, and the main tapped with ordinary drilling tackle; the drill, which is of ¼ in. or ⅜ in. diameter, passing through the open cock. On the work being completed, the drill is withdrawn and the cock closed. The service pipe, which may consist of either wrapped tube or good-quality steam pipe, is wherever possible welded together; otherwise screwed joints are made with lead and hemp, and tested by a Milne main-testing apparatus to a pressure of 50 lbs.

HOUSE GOVERNORS.

Inside the building an "Equitable" house governor is fixed; the sizes generally used being No. 0, which passes 60 c.ft. per hour, or No. 1, passing 160 c.ft. per hour. These are fitted with leather seating and mercury seal, from which a vent-pipe is carried to the outside of the building to a place of safety. [See figs. 2 and 3.]

The mercury seal serves as a safety valve in the event of the leather seating failing to act through any cause. Thus it is ensured that gas at high pressure cannot enter the meter. A pipe from the outlet of the governor provides the inlet for the meter in the ordinary way.

ADVANTAGES CLAIMED.

1. Less capital cost per mile of main, having regard to the increased volume of gas conveyed, compared with similar sized pipes at low pressure.
2. Greater flexibility as demand increases.
3. Pipes can be laid at less depths and at any level.
4. No syphons required.
5. No naphthalene or water-logged services.
6. Constant pressure at a consumer's premises when connected direct to high-pressure main.
7. Two or more consumers can be supplied off the same pipe without risk.

   A Case in Point.—About ten miles from the Company's works at Grays a 1-in. branch pipe over a mile in length is taken off the 4-in. high-pressure main, and supplies no fewer than 27 consumers. The aggregate quantity of gas consumed is more than 300,000 c.ft. per annum.
8. Better workmanship owing to severe test applied.

THE DISADVANTAGES.

1. Dependent on mechanical means for raising pressure.
2. Difficulty in welding-in branches on high-pressure main once having contained gas.
3. Probable shorter life of mains (dependent on soil).
4. Governors being thrown out of action owing to accumulation of rust or other foreign matter.

The chief difficulty experienced with the system has been the finding of slight accumulations of rust and other foreign matter carried forward and deposited in the seatings of the governors at various times—causing vents to blow in the case of house governors, and the larger governors to creep to excess and add pressure in the low-pressure mains during the hours

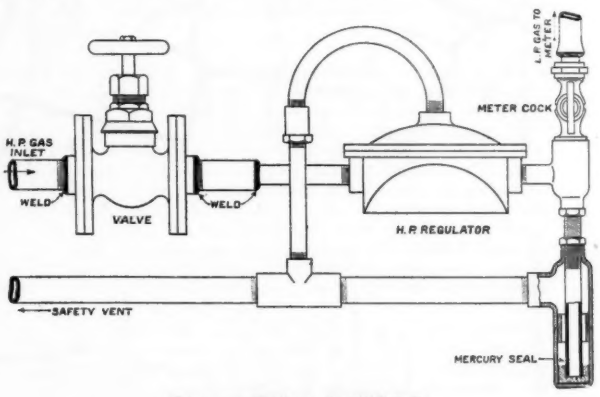


FIG. 2.—HOUSE GOVERNOR.

of small consumption. A sample of the matter affecting the seatings removed from the governors was analyzed; and it was found to consist of 73 p.ct. of iron rust, 22 p.ct. of silica or fine sand, and a very slight trace of naphthalene. It would, therefore, appear that, in order to reduce the possibility of such accumulations, every care should be exercised in seeing that all pipes are absolutely clean and free from rust before being jointed-up, and then well blown-out under good pressure before finally closing the end. It is also a mistake to place governor sets in underground pits [as shown in fig. 1], especially in low-lying districts where water may be troublesome and cause difficulty in attending to them. Whenever it is possible, they should be placed above ground and protected from the weather. In winter time the practice adopted in the case of the governors above ground is to cover them over with a good layer of straw. The leather diaphragms of these governors should be periodically oiled—say, every six months—and especially before the cold weather sets in; otherwise the leather will become stiff, causing a reduction in the pressure. Neatsfoot or almond oil is used for this purpose.

A WAR-TIME EXPERIENCE.

Late in December, 1917 (during an air raid), the 4-in. high-pressure main at Laindon was pierced by an anti-aircraft shell, almost cutting the main in two. This at once increased the demand, which was picked-up by the compressors, without causing inconvenience to consumers until two hours later an emer-

gency valve was closed, which cut off the supply to the Billericay section. As the shell was a live one, the military authorities were asked to remove it; and it was found the following day 8 ft. below the main. In order to repair the damage, a small section of the main was cut-out and a new piece welded-in. This was done by placing two bags in the main on either side of the section to be dealt with. When the joints were welded, it was impossible to test them except by gas, which was allowed to pass at from 5 to 6 lbs. pressure. By applying an oil-test, the joints showed a few small blow-holes. It was not desired to leave the work in this unsatisfactory state, neither was it deemed to be advisable to empty the main and remake the joints. Although risky, the welder agreed to repair the blow-holes while gas was travelling through the main; and this was successfully done without reducing pressure. The practice is not recommended; but it shows what can be done in cases of emergency.

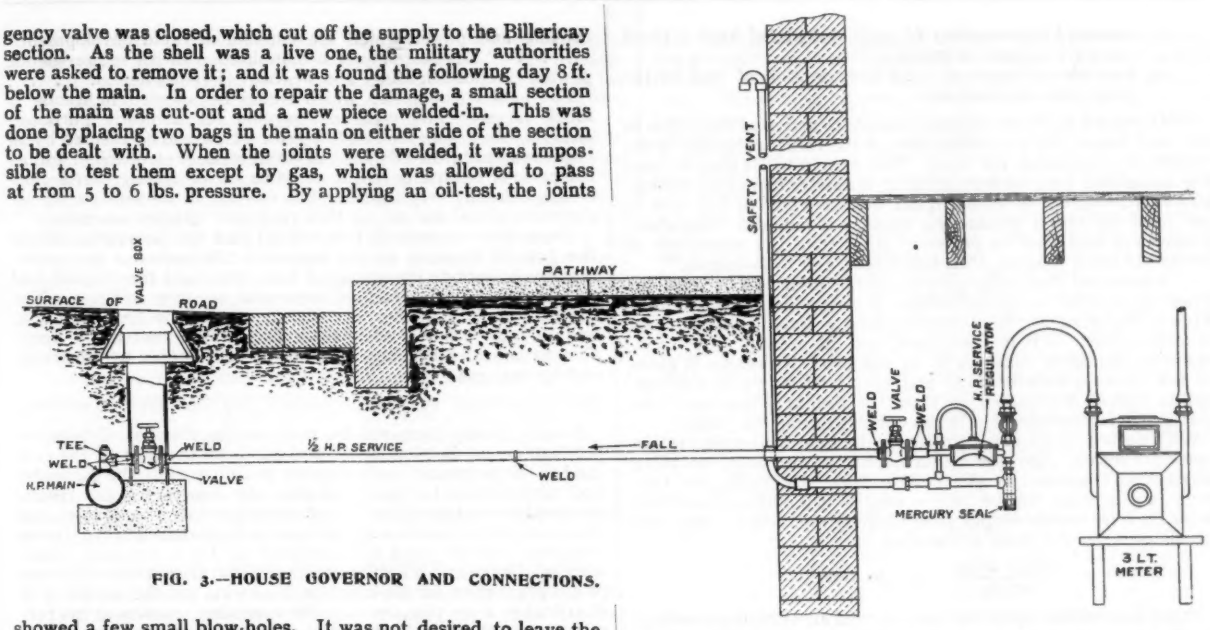


FIG. 3.—HOUSE GOVERNOR AND CONNECTIONS.

EFFECT OF COMPRESSION ON B.TH.U.

The results of tests made show a reduction in the B.Th.U. after compression, and travelling a distance of some eighteen miles, of 6 to 7 p.ct. This reduction is probably due to the fact that during compression a quantity of light oils and water are compressed-out and collected in the receiver on the works.

The gas distributed through the high-pressure system during the first complete year after installing (1915) amounted to 33,494,000 c.ft.; while for the year ending 1919 it had reached 47,199,300 c.ft. The total make of gas for the whole of the Company's area amounted to 207,126,000 c.ft. in 1919.

COAL CONSERVATION IN THE UNITED KINGDOM.

By Sir DUGALD CLERK, K.B.E., D.Sc., F.R.S., M.Inst.C.E.

[Extracts from the "James Forrest" Lecture before the Institution of Civil Engineers, April 20.]

Our present industrial civilization depends upon our supplies of fuel and motive power; and without coal, oil, and motive power it would be impossible to support in comparative comfort our population of 46 millions. A return to the agricultural civilization of 1750 would require the reduction of our numbers to one-third. This would be necessary if coal failed us or became unduly expensive.

The coal raised in 1913 was approximately 287·4 million tons; but of that, 189·1 millions were retained and consumed here. The balance of 98·3 millions were exported, partly to supply bunker coal for our ships, and partly to other nations to pay for commodities and services imported and rendered to us.

The total coal reserves at 2 p.ct. per annum increase would be exhausted in about 250 years. But long before that time fuel would be so expensive that we would be hardly pressed to maintain the existing population—we would have arrived at a stage of stationary or receding numbers. It is accordingly of the utmost importance to study the engineering problems arising under the changed conditions.

The work of the engineer may be applied to extend the period of our present prosperity by reducing the total fuel consumption or by increasing the means of existence more rapidly, and so increasing the power of supporting a larger population for a shorter term.

The coal raised and retained in 1913 was consumed in the following manner:

Coal Consumption in the United Kingdom during the Year 1913.

	Million Tons.
Railways	15·000
Coasting steamers (bunkers)	2·500
Factories	60·000
Mines	20·500
Iron and steel industries	31·000
Other metals and minerals	1·250
Brick-works, potteries, glass, and chemical works	5·750
Gas-works	18·000
Domestic	35·000
	189·000

These numbers are taken from the final report of the Coal Conservation Committee; and they have been calculated from values given in the Coal Commission report of 1903, by assuming a *pro ratâ* increase in the different items proportional to the total coal reserved for home consumption in the years 1903 and 1913. The division does not give any direct indication of the total coal consumption for motive power purposes or the total H.P.-hours developed by steam and other engines in the country.

Prof. Bone gives his estimate of the division of consumption in that year as—

	Per Cent. Approximately.
Power	40
Iron and steel works carbonization	27
Domestic	20
Transport	10

He agrees that it is difficult to state exactly the coal consumption in a given year for each of the above purposes; but he considers that the following values are tolerably accurate:

	Million Tons.
Consumption in mines and factories chiefly for power	80
Iron, steel, and other metallurgical industries	32
Bricks, ceramics, glass, and chemicals	6
Railways and coasting steamers	17
Gas-works	19
Domestic purposes	35

If these values be accepted, then power, gas-works, and domestic use consume between them 134 million tons per annum, or about 71 p.ct. of the coal consumption of the United Kingdom.

The Coal Conservation Committee under the chairmanship of Lord Haldane arrived at the conclusion that 80 million tons of coal were consumed in this country in 1917 for the production of power—including railways. They considered that only 25 millions would be required if the whole of the existing steam-engines in separate factories, and the steam locomotives on railways, were replaced by a great general system of electrical generation and distribution. For this purpose many of the existing electricity generating stations were to be purchased by the State, and large turbo-electric stations established at about sixteen centres were to be erected and their mains so linked-up as to cover the country with a network capable of supplying our whole power needs by electric motors. By this scheme the Committee expected to save 55 million tons of coal on power only, or to generate continuously 15 million H.P. in addition to the 15 millions now required by factories and railways.

If this be true, the super-stations would certainly justify their existence. But is the scheme well founded? Are the facts dealt with by the Coal Conservation Committee such as to justify the sweeping conclusions arrived at? Many competent electricians and most capable motive-power engineers have the gravest doubt as to the accuracy of the data presented, and as to the outcome of the ambitious scheme advocated.

The report assumes an approximate knowledge of four values:

(1) The amount of coal used in the United Kingdom for the production of power only.

(2) The amount of mechanical or electrical energy produced from this coal and used in driving workshops, mills, factories, electrical generation, and railways by steam engines, reciprocating and turbine.

(3) Assumed consumption of coal—calculated from (1) and (2) per B.H.-hour at present.
(4) Possible reduction of total consumption of coal by the proposed superstations.

With regard to (1) an attempt is made to arrive at this value in the final report, by a consideration of the values returned in the census of production for 1907. The conclusion is that in 1907 the estimated coal consumption in industry, including mining, was approximately 70 million tons; but the whole of this coal is not used for power production because it includes "important amounts of coal used for purposes other than the generation of power—in brick making, chemical trades, and bake-houses."

It is assumed that only 75 p.ct. of the total coal is used for power production in industry—that is 52·5 million tons. If railways be included, the total consumption is stated to be at least 65 million tons. It is further stated that the present [1917] consumption including railways is 80 millions. No reason is given for the increase between 1907 and 1917 from 65 to 80 millions, and no figures are quoted to show the probable increase from changing total consumption in the country during ten years.

With regard to (3) my estimate of the total coal consumption under (1) during 1907 for steam motive power only, including railways, as explained, is 48·7 million tons. Deducting for railways 12·5 millions we get 48·7 − 12·5 = 36 2 millions, and that under (2) total energy output 20,987 million H.P.-hours. The coal consumpton per H.P.-hour is therefore

$$\frac{36{\cdot}2 \times 2240}{20{,}987} = 3{\cdot}9 \text{ lbs. nearly.}$$

In the Committee report the value arrived at, without correcting, for steam consumption other than motive power, and without correcting the nominal H.P. for steam-engines, is 8.03 lbs. This number, however, is given up, and 5 lbs. per H.P.-hour is adopted from typical cases as mentioned in (2): "To select for each of the large industrial areas of the country a number of representative examples of each important industry when full data are available." This is done by the Committee; and they arrive at 5 lbs. as stated, and point to the fact that Sir George Beilby had adopted this value also no less than seventeen years ago. I have also made a comparison on these lines.

With regard to (4), which considers the possible reduction of total coal consumption by the proposed superstations, it has been shown in the discussion on (1) that after allowing for steam used for purposes other than motive power, the Coal Conservation Committee's estimate of 65 million tons consumption is reduced to 48·7 millions.

If we assume with the Coal Conservation Committee that superstations in the early future will generate 1 E.H.P.-hour on 1·56 lbs. of coal, then the possible consumption by the complete substitution of such stations for existing stations and power producing steam-engines, assuming the figure of 4·05 lbs., is:

$$\frac{1{\cdot}56 \times 48{\cdot}7}{4{\cdot}05} = 18{\cdot}77 \text{ million tons.}$$

The saving is 29·9 million tons. The saving, as contemplated by the Committee, on 65 million tons (the consumption for stationary engines), excluding 15 million tons allowed for railways, is:

$$65 - \frac{1{\cdot}56 \times 65}{7} = 44{\cdot}7 \text{ million tons.}$$

I have not considered the question of the coal consumption of locomotives, for which the Committee allow a present consumption of 15 million tons per annum. Mr. R. T. Smith, in his presidential address to the Institution of Electrical Engineers, states that if all the railways of the country be electrified, then it is possible to save from 7 to 8 million tons of coal per annum. Other electrical engineers are not so hopeful; but to complete our comparison we shall take from Mr. Smith a saving of 7·5 million tons per annum on railways. We then get as total "saving" 29·9 + 7·5 = 37·4 million tons per annum. Taking all the facts into consideration and assuming electricity in the future to be used for the generation of power and light only, then a reduction to 1·56 lbs. of coal per B.H.P.-hour would give a possible saving of not more than 37½ million tons of coal per annum. The saving of 55 million tons expected by the Committee is, in my opinion, based on fallacious reasoning.

Effect of Using Electricity for Generating Heat on Possible Coal Economy.

As has been stated, the foregoing discussion assumes that power and light are to be generated, not heat. But the Committee report clearly intends to generate heat also, and expects to do so with economy superior to the existing systems of coal and gas combustion. In Lord Haldane's prefatory note to the interim report made by the Power Generation and Transmission Sub-Committee it is stated that:

"The question of the conservation of coal so far as it falls within the reference . . . . is the question of economy in the use of coal through supplying electricity for power and other forms of energy." . . . ". . . and, being within reach of the community as a whole, the great benefits of an increase in the use of electricity for domestic purposes . . ." "This figure [55 million tons] takes no account of the saving possible on domestic coal consumption as the result of a comprehensive system of electric power distribution." . . . "In addition there are the various domestic uses of electricity, such as heating cooking and power, which are capable of rapid development." . . . "The economy of a combination of all requirements, power, traction, lighting, and heating, is fundamental." . . . "The coal consumption which would be affected indirectly is much larger. The coal consumption for domestic purposes, *including most of the coal used in gas-works*, would be affected by an improvement in the efficiency of production of electricity; for, as the price of electricity fell, *so would its use for lighting, heating, and cooking*, already very considerable, *increase in substitution for the direct use of coal and gas for these purposes*." (Italics are mine.)

From these statements it is evident that the Committee intend the general economy of the improved efficiencies of the superstations to include the supply of heat also; and they expect coal conservation to be further improved by this addition. The expectation of economy is evidently affected by heat supply as well as motive power and light. To test this matter it is desirable to consider first the question of heat supply by electricity and by coal gas.

Gas Compared with Electricity for Domestic Heating.

I have already discussed for coal gas the thermal efficiency of production and distribution of coal gas from the heat of the coal used in the process of carbonization to delivery into the gasholder and distribution to the consumer. By comparing the results obtained by the large London and many provincial companies, and comparing these results with the total coal carbonized in the United Kingdom and the total gas produced all for a complete year's working, I have arrived at the conclusion that the average efficiency of gas production for the kingdom is 46 p.ct., and the efficiency of distribution is 95 p.ct.; so that the consumer receives at his premises 43·6 p.ct. of the heat used at the gas-works ready to produce that quantity of heat on combustion.

I have also similarly estimated the thermal efficiency of the gas in use for domestic and manufacturing purposes. The main uses are gas-fires, boiling and heating water, gas cooking by oven, and metal heating and melting.

The efficiency of the gas in use is 42 p.c.—that is, the final efficiency referred to the heat consumption at the gas-works is 43·6 by 0·42 = 18·3 p.ct.

[Introducing the diagram that appeared in the issue of the "Journal" for Feb. 10 last [p. 295], Sir Dugald said it shows the present efficiencies of production, transmission, and use for gas and electricity in the year 1918.]

Electricity generated at a fuel consumption of 1·56 lbs. of coal per E.H.P.-hour gives a thermal efficiency of production of 13 p.ct. —that is, of 100 heat units consumed in the boiler-furnace the equivalent of 13 heat units are generated within the central station. The efficiency of transmission for short distances is 90 p.ct.; and the electricity consumer receives on his premises 13 × 0·9 = 11·7 p.ct. of the heat consumed in the thermodynamic transformation at the superstation.

The efficiency of electricity in use for domestic and industrial purposes—such as electric heating of rooms, electric heating and boiling water, and industrial metal heating and melting—is estimated by me as 59 p.ct. The consumer thus uses in his apparatus 11·7 × 0·59 = 6·9 p.ct. of the heat units consumed at the generating station. For equal heat actually applied to the work, gas thus returns 18·3 p.ct. of the heat production, distribution, and use; while electricity only returns 6·9 p.ct. For equal heat work electricity thus consumes $\frac{18{\cdot}3}{6{\cdot}9} = 2{\cdot}65$ times the coal of the country to do the same work. How would this affect the conclusions of the Committee report?

Assume for the purpose of testing the matter that the superstations are in being—generating and distributing by electricity the whole of the power estimated as in present use—then the total coal consumption per annum will be 18·8 million tons at 1·56 lbs. of coal per E.H.P.-hour. The old consumption under the present system of industrial (and not collective) power generation would be, as I have shown, 48·7 million tons. The saving shown is thus 29·9 million tons. This assumes all private power installations and nearly all existing generating stations to be abolished and replaced by the new superstations.

Assume now that gas-works in existence use 18·8 million tons of coal to generate heat at 46 p.ct. efficiency of production and 18·3 p.ct. efficiency of production, distribution, and use. The total fuel consumption between power by electricity and heat by coal gas will be 18·8 × 2 = 37·6 million tons. Assume the gas-works to be abolished and electric generating stations to be expanded so as to supply current for heat supply at the same generating efficiency as for power, and the heat to be the same as the total quantity produced and used by way of the gas-works, the 18·8 million tons of coal will then be increased 2·65 times—that is, 18·8 × 2·65 = 49·8 million tons of coal per annum will be consumed for the heating load. The total coal consumed for the combined supply of power and heat by way of electrical generation is thus 18·8 + 49·8 = 68·6 million tons; the total coal consumed for the separate supply of power by electricity and of heat by gas-works is 18·8 + 18·8 = 37·6 million tons; and the loss by adopting electricity for heating is 31 million tons per annum.

It remains to compare the result with the present fuel consumptions due to the existing systems. The consumption for stationary power I have estimated as being 48·7 million tons per annum, and adding the assumed consumption of gas-works for heat

48·7 + 18·8 = 67·5 million tons. If, then, the ideas of the Committee be carried out as to the supply of electricity for heating, cooking, and industrial metal melting and treating, as well as for power, the whole assumed saving on power will be lost, and 68·6 million tons of coal a year will be consumed, instead of 67·5.

In my opinion, on the facts which I have shown, the super-stations will not justify their existence. The Government scheme is wrong; and the sweeping conclusions arrived at by the Coal Conservation Committee are unjustifiable. In other words, there is no possibility of saving 55 million tons per annum of the fuel of the country by carrying out the full scheme. Some small fuel savings are possible by limiting the use of electricity to light and power; but such savings are being rapidly and safely effected by the individualistic system of separate power units under which Great Britain has led the way for more than a hundred years. In so far as electricity displaces gas for heating purposes, so far would the coal consumption of the country be increased.

The Committee also look to considerable displacement of coal used for domestic purposes by electric heating; the average heating efficiencies of coal as used for domestic consumption are not so high as gas, but they are higher than electric heating efficiencies; so that no saving could be effected here by the application of the Committee's views. No heat can be saved by electricity. Are there then other methods by which the country's fuel can be saved, or increased work obtained from the same quantity of fuel? I shall now discuss this question.

Methods of Saving Fuel Immediately Applicable.

In considering a general scheme of fuel saving for the United Kingdom, it is necessary to take a broader view than has been done by the Government Committees. Not only should the efficiency for motive power be considered, but the whole heating systems of the country should be dealt with in order to obtain a combined efficiency of heating, lighting, and motive power. To obtain a broad general view, it is thus necessary to study not only the distribution of heat, light, and power by gas and electricity, but also the other methods of generating and distributing heat for domestic and manufacturing purposes.

The gas industry has existed for over a hundred years; and it is at present a highly economical user of the country's store of heat. I have already shown that, in fuel economy, it far surpasses the electrical industry on the average consumption of coal required for a general service of heat, light, and motive power. In 1917 the gas industry carbonized 20 million tons of coal; and the heat of 10·8 million tons was used to produce and distribute the coal gas utilized in the United Kingdom, while the heat of 9·2 million tons remained available for use in the form of solid coke and semi-liquid tar and oil. The coal gas was produced and distributed at 43·6 p.ct. thermal efficiency; and its efficiency of use at the consumers' apparatus was 42 p.ct.

Great changes are now in operation throughout the gas industry—due to the adoption of the thermal unit standard for sale, and the passing away of the intrinsic illumination standards so long adopted. These changes allow of greatly improved thermal efficiencies of production and distribution. In a few years the majority of gas-works will deliver to the consumer in the form of gas 75 p.ct. of the whole heat of the coal used, and the improvements in gas apparatus, construction, and design are so great that the efficiency of use of the gas will rise from 42 to 55 p.ct.

The effect of these two changes will cause the consumption of coal to be reduced from 10·8 million tons per annum to 4·8 million tons giving the same service as at present of heat, light and power. If, however, the use of gas expands at its present rate, a double service could be given on 9·6 million tons. If we retain the same service, we save 6 million tons per annum on the gas industry alone. The consumption of coal for domestic purposes was 35 million in 1913; and it is highly improbable that the average efficiency of use exceeds 20 p.ct., including water heating and boiling, heating rooms by circulating hot water, cooking, and heating rooms by open fires. The efficiency of the open fire is certainly much less than 20 p.ct. although special tests with particular fires have given this result. My view as to the average efficiency of open coal fires in the United Kingdom is about 8 p.ct. But Prof. Bone differs from me, and suggests much higher values. It seems to me probable that Prof. Bone will accept 20 p.ct. as a high value for the average efficiency of the use of coal for domestic purposes.

I have shown that gas will shortly be produced and distributed at 75 p.ct. and used at 55 p.ct. of its thermal efficiency for general domestic purposes. That is, the ultimate efficiency from coal consumed at gas-works to heat utilized by the consumer is 0·75 × 0·55 = 0·41. From this, it is evident that at the new higher efficiencies of gas, it will economize the country's fuel resources to introduce gas to all households, instead of coal, for all purposes where coal is at present burned. This involves a very large increase of gas consumption and sale. On the assumption of complete displacement of coal in households by gas, the saving would be one-half. Instead of using 35 million tons, we should only use 17·5 million tons. We save 17·5 million tons on this item. Further savings will be made by the rapidly increasing use of gas for industrial purposes—including many varieties of furnace work so well described by Mr. Thornton and other able gas appliance engineers.

Under this heading I again return to the question of improvement in motive-power economy. I am in complete agreement with the desire of electricians to produce motive-power and light in a more economical manner than they do at present. I welcome the progress of electricity as shown from the Coal Controller's returns. Electricity is doing good work in the conservation of coal. The average consumption per B.H.P. for the whole country I estimate at 4 lbs. of coal; but the electrical generation of the country has reached the lower figure of 2·6 lbs. per B.H.P.-hour. It has become as economical of fuel as the textile industries. The purpose of reducing it still further to 1·5 lbs. and even 1 lb. is good and commendable; but the Coal Conservation Committee report advocates a line of advance following the direction of "colossal" standardization so characteristic of German ideas and development, which ultimately brought that country to ruin when pitted against the organized individualism of the British Empire.

The report regrets the impossibility of sweeping-away nearly all existing electricity generating stations and all private power producing installations, and replacing them entirely by super-power stations on the assumption that economy can only be found in this way. The report assumes and states that "large generating machines—not less than 20,000 H.P.—must be used; and they must be erected in the best possible position for economical production." Units of 50,000 H.P. are then stated to be more advantageous. This notion of the great gain to be expected from very large steam turbines is quite erroneous. The results depend but little on the use of very high powers.

The census of production of 1907 rates the internal combustion engines of the country as 644,836 H.P. In 1919, the stationary internal combustion engines of the United Kingdom developed at least 1 million H.P.; and it is to be noted that the values given in the Coal Conservation report deal in the main with steam motive power. A very small fraction of the total gas power of the kingdom is included.

The town gas industry at present supplies about 448,000 B.H.P. of gas-engines, or about 1344 million H.P.-hours per annum, at the efficiency of 25 p.ct. of the heat of the gas transformed into B.H.P., and 10·9 p.ct. referred to the coal consumed at gas-works. This is higher than the present efficiency of electricity generation. Electricity gives 6·8 p.ct. But with the higher gas-producing and distribution efficiencies referred to, the gas of the near future would give 18·5 p.ct. from gas-works to users B.H.P.

Electricity at 1·56 lbs. of coal per E.H.P. hour, and 90 p.ct. efficiency of distribution, gives 11·9 p.ct. of the current into the motor, and 11·9 × 0·9 = 10·7 B.H.P. from the motor. Gas power has thus the advantage of $\frac{18·5}{10·7} = 1·73$. At the more economical rate of fuel consumption, a great extension of gas motive power distribution may be looked for with confidence.

The electricity generated in the year ended March 31, 1918, was 4674 million units, which is equal to 6260 million E.H.P.-hours. At the same rating 3000 hours per annum at full load, 2·08 million H.P. were produced electrically. Gas power by suction and other producers mainly accounts for over 500,000 B.H.P. in internal combustion engines. Here the ultimate thermal efficiency exceeds 20 p.c. B.H.P. in internal combustion engines; and hence the ultimate thermal efficiency exceeds 20 p.ct. This is the highest figure to which electricians at present aspire. A recent examination by me of the limits of thermal efficiency of gas and oil engines, shows conclusively that 45 p.ct. B.H.P. may be obtained in the near future. Sir Charles Parsons at the same time prepared an estimate of the limiting efficiency of the steam-turbine as 28 p.ct.

Obviously, the use of the internal combustion engine will have a great effect in future in increasing the power and reducing the fuel consumption required for motive power, and this without requiring any departure from the individual generation of motive power in small units up to 3000 H.P. The great advantage of gas power is that small units, such as even 50 B.H.P., give efficiencies quite as high as that of the larger units of gas and super units of electricity.

So far small gas power driving for factories, whether by shaft and belt drive, or electric drive from a private works central station, have been superior in thermal and cost efficiency as compared with any public supply from great central electricity generating stations. The extension of the small power units, so long as it progresses in free competition with best electricity distribution, tends to reduce the fuel-consumption and conserve the fuel resources of the country.

Steam, internal combustion, and gas engineers welcome the free competition with electricity supply; but they consider that any attempt to crush-out the smaller power units by a great government scheme of general power production, will act against the best interests of the country, both as to coal conservation and economy in cost. There is an enormous field ready for steam, gas, and electric power in separate units, as well as in large (but not too large) central stations. There are several points in connection with reciprocating steam-engines, both condensing and non-condensing, which require consideration, and tend to show how motive power and heat supply are at present connected, and by their connection lead to economy of fuel.

Fuel Saving by the Use of Water-Power.

Further great savings of fuel are still possible by the utilization of the water-power of our country. The amount of the possible water-power has been somewhat understated. The investigation of the Board of Trade Committee on Water-Power Resources has shown that if necessary 1½ million H.P. could be obtained in the United Kingdom from the water at present running, without

surrendering its power. It is to be remembered that this 1½ million H.P. to be obtained from water can be produced with our water-power supplies continuously during the whole 8760 hours which form a year. That is, compared to steam and gas power, which is not generated continuously for more than half the time, the water-power would produce an equivalent of 3 million H.P., instead of 1½ millions. By using our water power we could add 3 million H.P. to the work of the country without consuming any additional coal.

Conclusions.

From the preceding discussion it will be seen that I do not accept the conclusion of the Coal Conservation Committee that it is desirable to substitute the electric generation and distribution of power, light, and heat by means of great super-stations for the existing means of supply, consisting of smaller generating stations, works driven by steam-engines on the premises, turbine or reciprocating, and internal combustion engines supplied by town's gas, producer gas, oil, and tar. The separate generation of power, for example, by internal combustion engines, at present gives higher economies than any steam-engines, however large; and the saving of many million tons per annum in power production may as well be claimed for gas-engines as for the proposed superstations.

The values for gas are more favourable than those for steam in any form; and if we are to extravagantly imagine the complete suppression of all motive power but one, then promises as large as are justified for electricity can also be made for internal combustion. Such promises, however, are dependent on the possibility of replacing the large amounts of capital at present sunk in separate motive power installations. Such replacements do now take place during the ordinary development of the country by healthy competition between rival means of producing power. The United Kingdom has progressed rapidly by free competition between steam-power in all its forms, internal combustion in all forms, and even in the application of our limited water power. The present competition between gas and steam has caused the rise in thermal efficiency of internal combustion engines from 16 p.ct. in 1876 to 30 to 35 p.ct. in 1920; and it will lead in the near future to 45 p.ct. as a maximum. During the same period steam has risen from about 8 to 20 p.ct.—the highest present efficiency of the best large steam-turbines at full load; and the efficiency may in the view of Sir Charles Parsons rise in the near future to 28 p.ct.

In my view it is desirable that the development of power and light generation should freely proceed in competition; and doubtless considerable economies can be effected over the existing results shown by the Coal Controller's figure.

The Coal Conservation Committee are quite wrong in considering that any advantage to conservation can arise from the use of electricity to produce heat by the existing means. Great loss must follow such use, as I have shown. If heat supply is to be included in the electricians' programme, then the present high-efficiency turbines must be abandoned, and the generation and distribution of power, light, and heat, effected by means of exhaust steam or to some extent by Lord Kelvin's reversed Carnot cycle. Such schemes, however, are very much in the future, in view of the very high efficiencies at present given by the coal gas industries for combined services of heat, light, and power. And it is to be remembered that the efficiencies in the gas industry will now rise rapidly, in view of the dearness of coal.

In my view, in the next ten years we may expect the general power consumption of coal to fall from 4 lbs. per B.H.P.-hour to under 2 lbs. per B.H.P.-hour—not only by the extension of electric generation and use, but by the extension as one element combined with the increased application of economical internal combustion engines and the improvement in steam-boiler and town gas and gas producer efficiency.

Gas and electricity have large uses still open to them in generating and distributing power; but it is undesirable that either should artificially displace the other by the uninformed decision of a Government Committee or a Bill in Parliament.

A vote of thanks to Sir Dugald Clerk for his lecture having been formally proposed by the President of the Institution,

Dr. Charles Carpenter, in seconding it, said it was important to bear in mind that Sir Dugald came before them not as an electrical engineer, nor as a gas engineer, but as a plain civil engineer, who gave an independent point of view after looking at the problems from an independent point of view. He could thus discuss them without bias; whereas it was very difficult indeed for those engaged in either of the two branches of industry to which he had referred to discuss the position in this way. He was struck with the part of the lecture which referred to the gas industry as being over a hundred years old; and it occurred to him to consider what would have happened had the electrical industry and the generation of electrical energy been discovered first and the distribution of energy in the form of gas afterwards. It was quite possible, had this been the case, that a different state of things might have existed to-day than did exist. They knew that the old gas engineer suffered from his own particular environment; and he (Dr. Carpenter) knew particularly when the question of recuperative furnaces—which was thoroughly worked-out in Germany, although over here Sir William Siemens did so much work on them—was brought out in this country, engineers whose names even to-day were household words, turned them down and asked whatever was the good of spending money on furnaces that would give a result that would merely save coke, which was then already a drug on the market. This state of affairs would never again occur; and it was very much further removed to-day than it was in 1914. If the consequences of the war had produced no other state of things, it had at any rate directed attention to the fuel problem; and he could bear-out what Sir Dugald Clerk had said, that this question was receiving very earnest attention from those who were associated with the various problems of dealing with coal and distributing it in the form of energy which would give the best efficiency. For the reasons he had mentioned, and also partly for the reason that the question had not been gone into so carefully in the past as it was being gone into to-day, and would be in the future, the present efficiency was not the best efficiency. He was extremely pleased to have the opportunity of seconding the vote of thanks to Sir Dugald Clerk, because he was one of those who had turned on to this question the search-light of scientific knowledge and investigation.

Sir Dugald Clerk acknowledging the vote, said he was extremely obliged to them for their patience in listening to the lecture. The younger engineers would find that in this energy problem there was an enormous future open to them. He well remembered when he read his first paper before the Institution in 1882. It was on the theory of the gas-engine; and a table was put in much the same as the one included in the present lecture. There were then big doubts expressed about it; but very little had been done with the gas-engine at all at that time. There had been enormous progress made since; and if he had the chance to be a young man again, he thought he would rather take the present position. It was one which appealed to him because the work before the engineer was so fascinating and so important to the welfare of the whole of the British race.

Repairing Holder Guide-Framing.

In the early part of 1919, a heavy wind blew a 50,000 c.ft. gas-holder free from its guides; and as it was the only storage of the company to whom it belonged, repairs had to be effected without putting it out of operation. The work of installing five new columns and a complete set of bottom rollers is described by Mr. C. O. Pratt, of Worcester (Mass.), in the American "Gas Age." Cutting the old columns out, and using a temporary support for the girder, it was possible to replace one column a day. Renewing the bottom rollers was a different matter, because it was necessary for the holder to be kept filled while working; and this was only possible between the hours of 2 and 7 a.m. It was at first intended to remove the cast-iron frames which supported the old rollers, and replace them with new ones; but as this course presented difficulties, it was decided to make-up a special roller-carriage frame of steel. This frame consisted of two sides and a back-plate, and was bolted to the holder sheets just above the old casting. To minimize gas trouble, two holes were first drilled and plugged. Then a plug was removed, and one end of a piece of flexible wire was pushed through into the interior of the holder. When sufficient wire had been pushed through, the wooden plug was re-inserted, thus holding the other end of the wire. The end that had been pushed through was then fished out from under the shell, and fastened to a bolt. The end of the bolt had been recessed in such a manner that fastening the wire to it did not increase its size. The bolt, carrying a large washer and heavy grummet, was then drawn into the hole by means of the wire. The operation was repeated on the second hole. The two wires were then strung through their respective holes in the roller-frame, and the latter set into place. The wires were removed, and the bolts fastened-up so as to hold the frame in place. The other two holes were drilled and bolted-up in like manner; this operation being repeated until all frames were in place.

Duty to the Gas Industry.

Reference to the claims of the gas industry in the United States to some better treatment than has hitherto been accorded them was made by Mr. H. S. Whipple, in his Presidential Address to the Illinois Gas Association. The gas company, he pointed out, is an essential part of the community it serves. The industry responded promptly and efficiently to the military needs of the nation in the production of materials needed; and the response is free from the charge of profiteering, and was made solely for public service. During the past four years, public utilities have had to contend, on the one hand, with heavily increasing costs of wages and materials; and, on the other, with a more or less stationary return for services rendered. The result has been that some companies have been brought to the verge of bankruptcy, and many have not earned dividends. The market for gas securities has been so impaired that it is almost impossible to obtain new capital, and, if obtained, high rates of interest are demanded. Even when an increase of rates is allowed, the valuation of the property involved and the rates allowed are so low that the companies cannot earn even a reasonable return on the capital invested. The public are the first to suffer from inadequate service; and inasmuch as proper service can never long be rendered in any line of business enterprise without reasonable compensation, it is incumbent upon the public to pay for the kind of service that they desire. The public cannot justly complain if they do not receive a character of service better than that for which they have paid. A controlling authority could do no greater harm to a community than to refuse to permit a public utility company to charge such rates for its service as will enable it at all times both to command the investment of money necessary for the making of required extensions and continued maintenance of its property in efficient condition, and also to render such character of service as the needs of the community reasonably require. The authorities must adopt a broader view of the situation, and make prompt adjustment of rates.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Corporation Tax and Statutory Companies.

SIR,—Can you find space for publication in the "JOURNAL" of the enclosed copy of a letter I have to-day sent to the Chancellor of the Exchequer, bearing on the imposition of the corporation tax to statutory companies? As regards the gas industry, in its present financial plight, this additional burden is one it should not be called upon to bear. Our position is such that we cannot afford to be mulcted in a new tax which is obviously intended to tap the swollen profits resulting from the contemporary prosperity of almost every industry in the land. Surely in this new tax we have a case where the maxim of "ability to pay" should be applied.

As far as I can see, the only hope of exemption is contained in the following question and answer in the House of Commons last Tuesday: "Mr. Pretyman asked if the corporation tax applied to co-operative societies. Mr. Baldwin (Joint Financial Secretary to the Treasury) said there was some doubt of the exact scope of the tax; but it would have to be settled before the Finance Bill was brought in."

It behoves all directors and gas officials to do what they can by way of protest to their members to secure, if possible, the exemption of the industry from this tax.

F. A. GULLAND, Secretary,
April 24, 1920. Maidstone Gas Company.

[ENCLOSURE.]

To the Rt. Hon. Austen Chamberlain, M.P.,
Chancellor of the Exchequer.

Sir,—In your budget statement on Monday last, the 19th inst., you said (speaking on the corporation tax):

> "I justify it on much broader grounds. Companies incorporated—that is limited liability companies—enjoy privileges and conveniences by virtue of the law, for which they may well be asked to pay some acknowledgment; and, more than that, while we see partners in a private partnership pay super-tax, not merely on the profits which they divide, but also on the undivided profits which they place to reserve, no such charge falls upon the undivided profits of limited liability companies. The corporation tax is justified by this distinction of the existing law in favour of such corporations, and which may be regarded as a compensation in lieu of the liability to super-tax."

While you endeavour to justify the imposition of this new tax on other grounds, it is fairly obvious that you were influenced in your decision to introduce the tax by the issue in various forms of new shares out of accumulated reserves.

No one can dispute the justice of your new tax on these grounds, which will secure the taxation of profits not distributed in the form of dividend during the year in which they are earned, but eventually distributed in the form of bonus shares. But I venture to urge, Sir, that this new tax will bear very unjustly on statutory companies such as gas and other public utility undertakings. Parliament has always jealously safeguarded the interests of the public too much to allow statutory companies to make more than a very moderate profit; and no reserve or renewal fund may be formed without the direct sanction of Parliament.

Further, the reserve and renewal funds which a statutory undertaking may set aside with parliamentary sanction are limited to a very moderate proportion of the capital raised; and the amount which may be set aside annually to these funds is also limited to a small proportion of the capital raised. Indeed, the sums which it is possible for many statutory companies to set aside are so meagre as to constitute a quite insufficient reserve, viewed from the standpoint of sound finance.

The position of my own Company in this regard may be stated:

Paid-up capital, including premiums realized on sale of stock	£183,123
Loan capital	56,176
	£239,299
The reserve fund (applicable to the equalization of dividends only) stands at £4600, although the market price of the investment is	£3,125
The Company's insurance fund is limited to	5,000
The amount which the Company may set aside to the renewal fund in any one year is limited to 1 p.ct. of the paid-up capital including premiums—*i.e.*	1,831
The total of the renewal fund is limited to one-tenth of the paid-up capital, including premiums—*i.e.*	18,312
The actual amount in the fund at present is	5,835

Small as these reserves appear, I do not put them forward as typical of the position of gas companies of approximately equal size to this; for I believe our position is better than the majority.

The position of this Company as regards dividends is as follows:

Pre-war dividend £7 5s. 6d. p.ct., equal to a return on the paid-up capital, including premiums, of £6 11s. 8d. p.ct.

Present dividend under the Statutory Undertakings (Temporary Increase of Charges) Act, £3 15s. p.ct., equal to a return on the paid-up capital, including premiums, of £3 7s. 10d. p.ct.

To you, Sir, the figures quoted above in connection with capital and reserves will appear small; but the principle involved touches a large number of concerns.

I submit that as regards statutory companies, owing to the restrictive conditions which attach both to the amounts payable in dividends and the sums which may be set aside by way of reserve, the application of the new tax to these companies would be unjust.

I venture to hope, therefore, that you may see your way to make provision in your Finance Bill for the exemption of statutory companies from the corporation tax.—I am, &c.,

(Signed) F. A. GULLAND.

Mr. Helps's Propositions.

SIR,—Whatever success these may practically have, Mr. Helps's demonstrations at the Central Hall have certainly convinced me personally that he has knocked the bottom out of the contentions as to the "inerts" bogies. And now the mischievous experts, "British asses," have been at work with the Board of Trade, we must bestir ourselves and oppose violently being beaten-down to useless new fetishes of a spurious scientific suggestion from persons who know nothing of the real problem of an economic position, which is to save coal by putting into the consumers' stoves the really cheapest, easiest-made, and most abundant heat product we can get from coal.

But—and this is a big "but"—how are we to accomplish the distribution of any gas of lower heat power, however cheap it may be, in mains which are at present enormously costly, and which are covered by modern pavements, costly beyond all past experience and most formidably expensive to destroy and renew for mainlaying purposes? Such mains are already overtaxed by the growth of the past six years, during which time no enlargement has been practicable, materially as well as economically.

HY. E. JONES.

13, *Queen Anne's Gate, Westminster, S.W., April* 21, 1920.

Stewart's Thermal-Balance of Coal Distillation.

SIR,—In his letter appearing in your last issue Mr. Stewart states that the "distillation of coal requires a net heat supply of 1,800,000 B.Th.U. per ton." This is a figure of such fundamental importance in any study of the thermal economy of carbonization that I venture to suggest that the value of Mr. Stewart's original paper would be considerably enhanced if he would supply the data upon which the result is based. Neither this figure, nor those of Prof. Lewes, which are quite meaningless to me, can be accepted until supported by evidence.

H. HOLLINGS.

April 14, 1920.

Gas Supplies and the Housing Scheme.

SIR,—Is it not time we ceased romancing and faced facts as they really are?

In reading the account of the proceedings of the Yorkshire Junior Gas Association (recorded in the current number of the "JOURNAL"), I find, under "Random Notes," a statement by Mr. E. L. Oughton, of Huddersfield, that the cost of installing gas in modern houses, &c., including carcassing, the provision of inverted pendants, incandescent burners, &c., with points for cooker, boiler, and gas-fires, would be approximately £1 per point, while "the lowest tender known to the writer for electric wiring (exclusive of fittings) is 25s. per point."

Such statements are particularly misleading to the uninformed, and do a considerable amount of harm to the gas industry. In these days of high prices, with materials costing over 100 per cent. more than in pre-war days, and the wages of a skilled gas-fitter about 1s. 9d. per hour, with a mate's wage in the neighbourhood of 1s. per hour, it simply "can't be done."

To illustrate my point, I would say that I have just been carrying out a test of carcassing two such houses as the writer referred to, with a view to determining an average cost to spread over some 600 houses. The houses were of an average type—three bedrooms, parlour, living room, scullery, bathroom, and the usual offices, necessitating gas-pipes for ten lighting points, one cooker point, one hot-water point, and four fire-points (sixteen in all). The actual net cost of this work—omitting any consideration for establishment charges, supervision, waste in cutting, use of tools, and various other items—amounted to £12 6s. per house, and involved the supply of 28 ft. of ⅜-in. barrel, 64 ft. of ½-in., 40 ft. of ⅝-in., 37 ft. of ¼-in., with the requisite connections, bends, elbows, tees, nipples, &c., for each house. If to this cost is added one two-light pendant, at 14s. 6d.; two high-class burners, at 5s. 4d.; eight one-light pendant, at 5s. 6d.; eight burners, at 4s. 8d.; ten mantles, at 6d.; ten pattresses, at 6d., with screw hooks, &c., and labour in fixing, we have a prime cost of over £18 a house with sixteen points. [The fittings priced are not up to the standard specified by the writer, but are the cheapest he would care to recommend for use.]

If Mr. Oughton is able to carry out work at the figure he mentions, he would certainly be conferring a boon on some portion of the community if he entered the field and contracted for some of the housing authorities' requirements.

To turn to the other extreme, one finds that in the discussion on the same subject at the Midland Gas Association meeting (also recorded in your current issue), Mr. Carder, of Oldbury, states that "the people were standing the cost of everything from the main; and it looked like about £50 a house."

April 22, 1920. DISTRIBUTION SUPERINTENDENT.

Recollections of the Settle Retort Working at Exeter.

SIR,—In view of the demands for higher pay on the part of gas workers, and of the very urgent need of making the most of our coal supplies, minimizing transport, and purifying our atmosphere, I venture to send you a few lines.

I write from the point of view of an outsider as regards gas production, except that some twenty-two years ago I had the very interesting experience of seeing and helping (in a humble way) in what must have been some of the earliest attempts to accomplish progress in three important points—namely, the easing of the severe labour of the retort-house staff, the increased yield of gas, and consequently the economic use of coal, by turning it into gas at a cheaper rate than by the older methods.

When I was City Analyst at Exeter, Mr. Tom Settle, the Resident Superintendent at the gas-works (backed-up by Mr. Padfield), began to experiment on the possibility of dropping coal into a vertical retort, instead of charging by shovel into horizontals. From the very start, it was clear that great advantages could be obtained if the initial difficulties could be surmounted. But they were considerable.

He worked first with coal in small pieces, and in powder (as the trial

apparatus was a small one). When the powdered coal fell into the hot retort, it gave off gas so quickly that the seals were blown and the station meter hand raced round. But the worst trouble was that the coke was quite feathery—one could powder it up in the fingers.

I have no notes of the experiments, but as far as my memory serves, 14,000 to 15,000 c.ft. of good-quality gas were obtained experimentally in this way in 1898. A little later Mr. Settle introduced steam into the retort and got 17,000 c.ft. of gas. I left Exeter for Africa in 1900, and so lost touch; but Mr. Settle has been working with steady persistency ever since, and seems to me an example of patient and persevering energy.

I hope to see the day when no more horizontal retorts will be put in; for the labour they involve is a great strain, and the results can never be as good as are possible with verticals.

It seems to me that the use of coal to cook with and warm our houses with is wrong; and that even if the modern type of plant costs more than the old horizontal retort, we ought as a nation to insist that the best plant should be used in future.

If any shareholder in a gas undertaking feels doubt as to which is best, he should go and see the labour involved in charging and drawing the respective retorts, and examine into the yields obtained.

C. G. Moor,
Late Captain, 1st London Sanitary Company,
R.A.M.C. (T.), M.A., F.I.C., A.I.M.M.

4, *Elm Court, Temple, E.C., April* 24, 1920.

National Association of Technical Gas Officials.

Sir,—Towards the close of 1918, a conference was held in Birmingham of representatives of most of the District Gas Associations of Great Britain, at which the status and remuneration of officials engaged in the gas industry was discussed. A further meeting was held in London in May, 1919, which was attended by engineers and managers from all parts of the kingdom; the opinion being freely expressed that an Association should be formed of technical gas officials. A Provisional Committee was appointed, with instructions to draw-up a draft constitution, and obtain guarantees of financial support to meet the preliminary expenses. The Committee have met on many occasions, and at their last meeting approved of the draft rules and constitution drawn-up by a Sub-Committee. These rules will have to be considered and modified by a General Committee of members which it is hoped will be held in June next.

Until the formation of the "N.A.T.G.O.," no organization existed to promote the personal interests of those engaged in the gas profession. The Institution of Gas Engineers and the various District Gas Associations afforded their members opportunities for meeting and discussing matters in connection with the industry; but the gas undertakings mainly benefited by these interchanges of ideas. Other organizations have been formed for safeguarding and promoting the political and commercial welfare of the industry, such as the National Gas Council and the British Commercial Gas Association. The manual workers are organized in various trade unions; but the officials, excepting clerks, had no organization to protect their interests. This is now being remedied; and the Committee hope that very soon the Association will have the support of all those who are eligible for membership.

The promoters of the "N.A.T.G.O." have two main difficulties to contend with—viz., prejudice and apathy on the part of many of the gas engineers in the country. Prejudice is chiefly shown by senior members of the profession, who, while satisfied with the present condition of affairs, object to the formation of a new and untried Association, with somewhat unorthodox ideas. Apathy is more difficult to contend with, owing to its illogical attitude. Invitations to join the Association are met with the question, "What shall we gain by joining?" The answer is that they stand to gain nothing unless such an Association is properly established, and until it has the support of the whole body of gas engineers and other technical gas officials behind it. Others, again, say, "My board or committee have treated me very liberally, why should I worry?" To help your less fortunate brother engineers.

The objects of the Association, as set forth in Rule 2 (in draft), are as follows:

1.—To raise and maintain the efficiency and general status of the technical officials engaged in the gas industry.
2.—To act as a protective organization on behalf of members of the Association.
3.—To ensure that only qualified persons are appointed to responsible positions involving the engineering, management, direction, control, or other positions in the technical departments of the gas industry.
4.—To deal with all matters of superannuation, security of tenure, and other matters affecting technical gas officials.
5.—To obtain representation at all conferences affecting members and the interests of the profession.
6.—To obtain for members the best possible conditions of employment and adequate remuneration, compatible with the training and responsibility required.
7.—To provide legal assistance for members, when necessary, so far as is allowed by law, in matters appertaining to their employment, and for securing compensation to members who suffer by accident or otherwise in their employment.

It is generally agreed that the salaries paid in the gas profession are inadequate, if the best and most qualified men are to continue to be attached to the industry. The remuneration compares badly with that obtaining in other professions; and at the present time there is every inducement for progressive men to seek better positions in other walks of life. The Association will endeavour, by co-ordination, unification, and thorough organization of the profession, to raise its status and improve the economic position of its members.

Technical gas officials are cordially invited to become enrolled in our membership, and so enable the organization to truly reflect the combined views of the profession as a whole. So far the response has been most encouraging; but my Committee feel that the Association will not be truly representative unless the main bulk of the profession is enrolled.

Full information as to membership, forms of application, &c., can be obtained from the General Secretary.

F. Herbert Stevenson,
55, *Temple Row, Birmingham, April* 20, 1920. *General Secretary.*

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Uxbridge and Wycombe District Gas Bill.

A petition of the Uxbridge Gas Company for leave to bring in a Bill to provide for the transfer of the undertaking of the High Wycombe Gas Light and Coke Company, Ltd., to the Uxbridge Gas Company, to extend the limits of supply of the latter Company, to change their name, and for other purposes, together with a copy of the proposed Bill, was read, and referred to the Examiners.

Progress of Bills.

The Public Utility Companies (Capital Issues) Bill was brought from the Commons, and read the first time.

The further Standing Orders applicable to the Rochester, Chatham, and Gillingham Gas Bill have been complied with.

The Masham Urban District Council Bill was read the third time, passed, and sent to the Commons.

The Rochester, Chatham, and Gillingham Gas Bill was read a second time, and committed.

Protection of Special Industries Bill.

Lord Balfour last Thursday formally moved the second reading of the Bill to prevent dumping, and to establish a special Industries Council to advise as to the promotion and assistance of special industries.

Earl Beauchamp, in moving as an amendment—"That this House refuses to proceed further with a Bill the result of which will be to legalize profiteering and to increase the cost of living," said he regretted that dumping and key industries had been dealt with in a single Bill. He looked upon the measure as a kind of conspiracy against the consumer of this country, as, whatever happened, he had to buy more expensively than before.

The amendment was carried by 23 votes against 22; and the Bill was therefore rejected.

HOUSE OF COMMONS.

Progress of Bills.

It was reported that Standing Orders not previously inquired into had been complied with in the case of the Maidenhead Gas Bill.

The Maidenhead Gas Bill was read a second time, and committed.

The Masham Urban District Council Bill was read the first time, and referred to the Examiners.

The Redcar Gas Bill and the Rugby Gas Bill were reported, with amendments.

Benzol Production from Coke-Ovens and Gas-Works.

Sir R. Horne (the President of the Board of Trade), in reply to a question addressed to him by Captain Moreing, said that the total production of refined benzol at coke-ovens and gas-works in 1919 was approximately 20,000,000 gallons.

Gas-Works and Seaborne Coal.

Colonel Burn asked the President of the Board of Trade if he was aware of the great hardship inflicted on towns that received seaborne coal, and had to pay considerably more for their gas and electric light owing to the increased cost of transit of the coal; and would he take steps to get the cost of coal delivered by sea in excess of that sent by rail divided among the various gas undertakings throughout the country.

Sir R. Horne said he was aware that the cost of coal conveyed by sea for gas and electric light undertakings was in excess of that conveyed by rail. Owing, however, to the congestion on the railways, and to the difficulty in obtaining sufficient wagons, it was not practicable to make any change at present. He was not prepared to take the steps indicated in the concluding portion of the question.

Colonel Burn asked if it was not a great hardship that certain towns had to pay so much more for their gas owing to the price of coal. If coal was carried at present by rail to Newton Abbot and delivered there, why could it not go on to Torquay, which was only five miles further on?

Sir R. Horne replied that Colonel Burn sympathized with the places that were situated on the sea; but they were obtaining the advantage at present of getting coal by rail, and consequently cheaper than in the old days when they had to get it all by sea.

Coal Shortage in Gas-Works.

Colonel Burn asked the President of the Board of Trade if he was aware that some gas undertakings had only one week's supply of coal in hand.

Sir R. Horne said he regretted to say that this was not an unusual condition for gas-works in the United Kingdom. He thought that the particular cases in which Colonel Burn was interested were not more remarkable than others.

REDCAR GAS BILL.

The Unopposed Bills Committee of the House of Commons considered this Bill on Thursday last, and ordered it to be reported for third reading.

Mr. Johnson (Messrs. Torr, Durnford, & Co., Parliamentary Agents)

said the Bill enabled the Redcar Urban District Council to purchase the undertaking of the Redcar, Coatham, Marske, and Saltburn Gas Company—an amalgamation of the Redcar Company and the Saltburn Company which were authorized in 1876 and 1878 respectively. There was nothing unusual in the Bill. The purchase price had been agreed at £115,000, out of which the Company had to discharge its mortgages amounting to just over £5000. The limits of supply were to be the same as at present. Dealing with the point raised on clause 21, this had been met by fixing the maximum price at 5s. per 1000 c.ft., or such higher price as might be approved by the Ministry of Health. Originally, the clause gave the Council power to charge such higher price than 5s. as would not be more than sufficient to carry on, as far as could be estimated, without loss. Now, any increase over 5s. was to be approved by the Ministry of Health. This was a very moderate maximum price, because the present actual charge was 4s. 10d. On clause 24, the Ministry of Health raised the question of the period for loans. He would call Mr. Valon, the Council's Consulting Engineer, to speak with regard to this. A number of cases were quoted by the Ministry as having been dealt with last session. In the majority of these cases, the period was 35 years.

Sir ERNEST MOON (Speaker's Counsel) said he supposed during the last six years very little had been done in the way of renovation.

Mr. JOHNSON said he was told the works were in very good order.

Mr. *Arthur Valon*, Consulting Engineer, said he had advised the Council with regard to the purchase of the works, and had been advising since 1913, at which time the Company last came to Parliament. The works were started in 1876; but none of the original plant now existed. A great deal of renewal had been done during the past few years out of revenue, and much extension work had also been done during the past twenty years out of revenue. The whole of the carbonizing plant was new, and was only finished last year. The retorts were horizontal with modern machinery, overhead bunkers, &c.

The CHAIRMAN: Did you advise them to put in horizontal retorts nowadays?

Mr. *Valon* said that when using Durham coal it paid to put in horizontal retorts instead of vertical. So far as economy was concerned, it was still an open question; but so far as freedom from nuisance was concerned vertical retorts were much better than horizontals. The present horizontal retorts at Redcar were absolutely new. He had known horizontal retort-benches to remain in existence in use for 40 years. The retorts themselves, of course, would be renewed fairly frequently. The rest of the works at Redcar were also in very good condition. He had recently seen a section of the mains, which had been taken out for some purpose; and though they had been down for many years, they were in excellent condition. The leakage was only 5 p.ct., against 8 p.ct., which was the average for the whole of the country. He was quite satisfied that the works were not in any way dilapidated, and that 35 years was a fair time as a period for repayment of the purchase price—indeed, he was hoping the Committee might have granted 40 years.

The CHAIRMAN remarked that 35 years was the limit.

Mr. *Valon*, answering further questions, said that the storage capacity showed a margin of 30 to 40 p.ct.; retorts also had a considerable margin. In regard to the purchase price, this was agreed before he was called in on the Bill; but he thought both the purchaser and the vendor had made a fair bargain. The position was rather a peculiar one. Owing to the conditions during the war, the Company had paid a lower dividend than before the war. Before the war, however, they made very much larger profits than were necessary to pay the standard dividend, and renewals and extensions had been paid for out of revenue to some extent. The result was that the capital account was small. The Local Authority, in settling the purchase price, had the advantage of this, in that they had had to buy out a small profit. The purchase price represented just under 20 years' purchase of standard dividends. Dealing with the periods of borrowing for other purposes, he said that £40,000 was asked-for for 40 years for alterations and extensions to the works. A similar period was granted in the case of Chelmsford in 1915. For new mains, the period asked was 30 years; the amount being £30,000; for meters, stores, and fittings, the amount was £25,000, and the period 15 years. All the periods were in accordance with precedent.

The financial proposals were agreed to.

Mr. JOHNSON asked that a minor amendment should be made. Under section 6 of the Company's Act of 1913, power to lay mains for ancillary purposes was limited to the district of Redcar; but naturally it was now desired that it should not be so limited.

The amendment was agreed to, and the preamble of the Bill was proved.

RUGBY GAS BILL.

The Bill promoted by the Rugby Gas Company was on Thursday last sent forward by the Unopposed Bills Committee of the House of Commons, presided over by Mr. J. H. WHITLEY.

Mr. LEES (Messrs. Lees and Co., Parliamentary Agents) said the Bill authorized the Rugby Gas Company to construct new gas-works on a site which had been acquired by agreement adjoining the Rugby and Leamington branch of the London and North-Western Railway, and to raise £150,000 of new capital. There had been great development at Rugby. The Company had intended to come to Parliament with this scheme in 1915, but had been prevented by the war. The new works were badly required. Up to the commencement of the war, gas was supplied at 2s. per 1000 c.ft., and everybody was very pleased with the Company.

The CHAIRMAN commented on the fact that there was no report from any Government Department.

Mr. LEES said the Ministry of Health would not be concerned, as it was a Company Bill.

The CHAIRMAN: How about the Board of Trade?

Mr. LEES: They can find no fault with it.

The CHAIRMAN said that, nevertheless, a report was usually made.

Mr. LEES said there was no obligation to make a report on a Gas Bill; but there was in regard to an Electricity Bill.

MISCELLANEOUS NEWS.

EXAMINATIONS IN GAS ENGINEERING.

City and Guilds of London Question Papers.

The following were the questions put to candidates last Saturday in the examination in "Gas Engineering," held under the auspices of the City and Guilds of London Institute. The Examiner was Mr. Samuel Glover, of St. Helens. The maximum number of marks obtainable is appended to each question.

GRADE I.

1. Show, by sketches, a longitudinal view of (*a*) a moulded retort supported above the combustion chamber on its supporting walls, (*b*) a segmental retort—in both cases showing how the iron mouthpiece is connected to the retort. (45.)

2. What is the cause of the formation of clinker in a producer heating gas-retort settings? Describe the process of clinkering a producer, and say what form of grate you find best from your experience. (40.)

3. Describe the forms of (*a*) a hydraulic main, and (*b*) a dry main in the construction and working of a bench of horizontal retort-beds. (35.)

4. What points are most necessary to control in gas manufacture so as to secure the production of large makes of combustible gas per ton of coals? (45.)

5. What is a water-cooled condenser? Show, by a sketch, the construction of an approved form, giving gas-passages, water space and circulation, and extraction of condensates. (35.)

6. What are the impurities contained in crude coal gas? Give such details as you can, and say at which points in the whole purifying process each of the several impurities is removed, and to what extent. (45.)

7. Describe the liquid products of a gas-works and how they are gathered into the store-wells; how separated and prepared for sale in the best manner; and how sold. (30.)

8. Show, by the help of sketches, a section of a brick and clay puddle gasholder tank. Include a section through the dry-well, or show another method of introducing the gas into the holder and taking it out. (45.)

9. Describe the best modern methods of treating coal gas containing naphthalene to prevent the naphthalene being deposited in a solid form in the mains, services, and meters on the district. (40.)

10. State, in a concise manner, the conditions affecting the length of the working life of wet and dry gas-meters. What are the tests to which meters should be subjected when received from the makers, and after having been at work on the district of supply? (25.)

FINAL.

1. How would you proceed to dry a newly-completed bench of six retort-settings and bring three of the beds up to working heats; regenerator furnaces being provided—one to each through setting of retorts? State the precautions you would take to prevent any explosions taking place within the settings. (40.)

2. Describe, with sketches and measurements, the various sections of retorts and the general arrangement of retort-settings used to your knowledge, either in small, medium-sized, or large works, and enumerate any particular merits proved to belong to any particular section of horizontal settings—first, for gas-making; secondly, for coke making; and thirdly, for facilities of working. (45.)

3. What conditions in the carbonizing plant would favour the production or presence of the following in the unpurified gas: Oxygen, carbon bisulphide, hydrocyanic acid, ammonia, methane, carbon monoxide, nitrogen, carbon dioxide, naphthalene, and benzol? (45.)

4. Give details of improvements made in retort-furnaces having for their object the abolition of horizontal grate bars and the use of false bars during the operation of clinkering. What useful part is performed by the presence of water and the admission of steam under a furnace grate? State the reason for the wearing-away of the side walls of a furnace. (35.)

5. Show, by three sketches, the progress made in the design of hydraulic mains and bridge pipes, giving reasons for the choice of design for both main and bridge pipe that you would recommend. Under what conditions is it possible to work retorts without liquid seals? (35.)

6. Describe the most modern methods of gas making in continuous vertical retorts. What are the best results to aim at in respect of gas and other products per ton of coal? What takes place in the retorts to enable these results to be obtained, and what conditions of control are necessary to enable the best results to be maintained? Give the chemical composition and calorific value of the gas that you consider the best to supply. (40.)

7. Describe a modern recording calorimeter, giving sketches of a complete view or of parts. State the work the instrument is made to do, and the physical laws which control its action. (30.)

8. Draw, in outline, the plan of a modern gas-works for the production of 2,000,000 c.ft. of gas per day, giving the sizes of the various pieces of apparatus and any details of construction you can include. (40.)

9. Show, by means of a sketch, the construction of a wet or dry gas-meter, clearly indicating how the work of measuring is accomplished, and state the effect of varying pressures on the recording principle of the meter, giving your opinion as to how wet and dry gas-meters are best kept in good order and condition. (25.)

10. Show, by means of a sketch plan, how you would propose to lay out the gas-mains, house services, and lamp supplies on a new building estate which is planned to have wide main roads with houses on both sides at frequent intervals, and many branch roads off both sides at irregular intervals. The site of the new district is six miles from the gas-works and three miles from the fringe of the town already supplied, at which point the road from the works has risen 600 ft. The district

to be supplied beyond is only 100 ft. above the level at the gas-works. How would you propose to connect-up and maintain a constant pressure in the new district, which is expected to demand a total supply equal to 25 p.ct. increase on the total works' output? (40.)

THE COMMITTEE ON SMOKE ABATEMENT.

Further Evidence with Regard to the Use of Gas in Connection with Housing Schemes.

A further sitting was held last Tuesday at the Ministry of Health of the Departmental Committee on Smoke Abatement, under the chairmanship of Lord Newton. The Committee have been turning their attention particularly to the problem as bearing upon the housing schemes at present in contemplation; and further facts with regard to gas were placed before them at this sitting.

Present Position and Future Development of the Gas Industry.

Dr. E. W. Smith, Chief Chemist to the City of Birmingham Gas Department, stated that he appeared at the request of a member of the Committee, and with the permission of the Corporation. He had been asked to make some observations on the position and future developments of the gas industry in regard chiefly to quantities of gas made and the probable cost. The present position of the gas industry, he said, is quite abnormal. The difficulties of getting coal, the price of coal, and particularly the condition of plant due to the war, are such that the production of gas of pre-war type no longer holds good, and the cost of production is higher than it would be if the works were in normal condition of repair. This state of affairs is, of course, not peculiar to the gas industry. There is a distinct difference between conditions existing with corporations and those existing with companies which are controlled officially by the sliding-scale. Companies are controlled in their selling price of gas in proportion to the dividend they declare; and this is hitting them very severely at present. Corporations have limits of price; but this does not affect the question of allocating profits to the rates. Generally speaking, all gas undertakings are putting their works in proper order, reconstructing, and extending them. The industry can supply now, and will be in a position to supply in the future, any gas that may be required. In spite of everything, the price of gas generally has not gone up to the same extent as the price of coal; mechanical operations and other reasons having caused the price of gas not to go up so rapidly. The gas industry has probably gained more from the war than any other heating or power producing industry in the country. In pre-war times, the industry was compelled to supply gas which of itself possessed a lighting value without the use of an incandescent burner. During the war, however, the whole basis of the supply of gas has been changed; and it has to be furnished on a heat basis. Owing to the difficulties of the war, gas qualities, which on the former basis possibly approximated to 600 B.Th.U. per c.ft. gross, had to be reduced to figures approximating to 450 B.Th.U. gross. The compulsory experience of having to use such gas in existing appliances has taught the industry that the consumer is not placed at any disadvantage from this drop, subject to the B.Th.U. being supplied at the same price. In other words, the efficiency obtainable from a gas of lower calorific value is equal to the efficiency of the gas of higher calorific value for purposes of domestic heating, lighting, and even in furnace work, unless the value is reduced very low.

Prof. Cohen: What would be the minimum?

Witness: I am of opinion that for domestic purposes, with already existing appliances, 450 B.Th.U. is the minimum that should be supplied. That is, distinctly, with already existing appliances, unaltered in any way, but with adjustment provided for.

Proceeding with his evidence, witness remarked that the gas industry welcomed the report of the Beilby Committee almost in its entirety, in that it provides for the sale of gas on a thermal basis, rather than in cubic feet as hitherto. The limitation of inerts is not a matter which is welcomed by the industry; but no doubt it will be conducive to greater regularity in the composition of the gas. As he had said, it matters very little to the consumer whether he gets high or low calorific value, subject to his obtaining his B.Th.U. at a corresponding price. During the war it was found possible, in vertical retort installations, to very considerably increase the quantity of gas made per ton of coal by admitting steam to the retorts. Quantities of gas have in this way been obtained up to 30,000 c.ft. per ton, as compared with (say) 12,000 c.ft. The calorific value would drop; but the actual number of heat units obtained from a ton of coal would be increased from approximately 7 million out of a possible 28 to 30 million (depending on the coal used) to 15 million. Obviously this is a great advance in the efficiency of gas heat-unit production from a ton of coal. Really what happens is the combination in one installation of ordinary gas production from retorts with blue water-gas production in an outside generator. In ordinary gas-works practice it is normal to make blue water gas of a calorific value of about 300 B.Th.U., which is mixed with rich coal gas, and a lower quality gas than straight coal gas is produced. This is not an efficient combination of processes, because the heat of gasification in water gas is lost. But by taking advantage of the heat that is in the residual coke in vertical retorts, a large quantity of gas can be produced over and above the normal production. A further extension of this idea has been in what is known as complete gasification. There are two or three systems being tried in this country, and a number of plants are being erected. In complete gasification, it is possible to obtain anything between 55,000 and 60,000 c.ft. to the ton, which has not more than 5 or 6 p.ct. of inert constituents. This, again, is an example of increased efficiency in gas production per ton of coal. If he were advising a gas undertaking what to do to increase quickly its gas production, he would recommend that complete gasification plant should be installed, in order that the gas so produced should be admixed with rich coal gas, to give a gas of a minimum calorific value of about 450 B.Th.U. gross. This would be, in his opinion, much more efficient than the normal procedure of putting in blue water-gas plant in the ordinary way. As to whether the cost of production of B.Th.U. is going to be reduced by such a process of complete gasification to the extent which has been suggested, he is doubtful; but he did know, from their experience in Birmingham, that partial gasification of the coke in the form of steaming does reduce the cost of production of gas very considerably. The nation does not realize that the gas industry is so fundamental to its continued existence as a leading commercial power.

The Chairman: Why do you say that?

Witness: What I mean is that the experience of the gas industry during the last three or four years has been that it obtains very little sympathy officially from any Government Departments; and this, I believe, is due largely to lack of knowledge of the operations of the industry.

The Chairman: What do you mean by sympathy of Government Departments?

Witness: The difficulties of getting coal have been obvious to everyone; and there seems to have been little sympathy expressed by action on the part of the Coal Control Department in providing suitable coal.

The Chairman: Do you think the Coal Controller should have treated you better than he did?

Witness: I consider it should have been possible for the Coal Controller's Department to have sent us other than (say) anthracite coal for gas production at a gas-works, which is frequently done. It should have been possible to send household coal to districts where it is required for household purposes, and gas coal to gas-works; whereas the process has often been reversed. It should have been possible to have made arrangements with the gas industry of a more equitable nature for the installation of benzol and toluol plants, which were put up entirely for the purpose of the Government, and so on.

Continuing his evidence, Dr. Smith said that sulphuric acid is probably the standard and basic product of the chemical industry; and the gas industry now supplies the raw material for the sulphuric acid industry. This is an important point. Again, most of the ammonia which is necessary for the textile industry is obtained from the gas industry. The same with dyes. Now, in complete gasification of coal there is a reduction in the quantity of bye-products, and in their value; and even though it is possible that a higher thermal efficiency may be obtained from complete gasification, it would be fatal to the industry of the country if these bye-products were not available, or were seriously reduced in quantity. As to the suggestion to legislate that no gas shall contain more than a certain proportion of inert constituents, surely it is the gas industry that will desire to keep inert constituents down, because their effect is purely in connection with production and distribution. The gas industry is not likely to produce gas of high inert constituents, if it can possibly help it. The gas industry should receive every encouragement, and not remain crippled with restricted regulations. The only condition of supply should be that each gas undertaking shall guarantee a product of reasonably constant quality at adequate pressure, which will give a satisfactory efficiency when used in suitable appliances. From the point of view of smoke abatement and of national economy, Parliament should restrict the use of coal in open domestic grates, either by rationing coal or by forbidding the use of more than one open fire-grate per house. Later, coal would be forbidden for domestic use altogether.

The Chairman: You make rather a drastic suggestion in prohibiting open grates altogether. With a view to purifying the town, I suppose the Corporation would like to increase the use of gas-stoves?

Witness: Or any other process that would not produce smoke. Birmingham has done more in the way of gas heating, both domestic and industrial, than most other cities.

Captain Hamilton Benn: How much would complete gasification reduce the cost?

Witness: It might reduce the cost of gas into the holder by 33 p.ct. It is possible for us in Birmingham to increase our production or reduce it at a moment's notice, by increasing or reducing the steaming.

Prof. Cohen: You suggest one coal-fire per house. Would this be satisfactory for large houses?

Witness: In Birmingham, it is normal to have not more than one coal-fire in a house. In large houses a difficulty may arise, as it is apt to be the æsthetic side rather than efficiency that is considered.

Prof. Cohen: Do you think we, as a Committee, should be doing an unjust thing by restricting every house in the country to one coal-fire?

Witness: My view is that if the good of the community demands it, it is not unfair to the individual.

Captain Hamilton Benn: Is there any way in which the quantity of water in coke supplied to the consumer can be regulated?

Witness: The latest design of vertical retorts ensures that, unless the water is deliberately put there, the water in the coke shall not exceed 1 p.ct. In Birmingham we have a 16½ million c.ft. works which make nothing but this particular coke; and the demand for this works' coke for domestic purposes is excessive. The coke from all our works is tested daily; and the normal amount of water in the coke other than from the verticals is about 5 to 6 p.ct., due to the quenching. The sufficient quenching of coke is necessary in order that it shall not relight in the wooden railway trucks, and burn them.

Healthy and Unhealthy Conditions of Life.

Prof. Leonard Hill, M.B., F.R.S., who was the next witness, submitted evidence with reference to desirable and undesirable conditions of warmth and ventilation. Contrasting the ideal conditions of warmth and ventilation—*i.e.*, those which prevail on a sunny spring day, when the body is warmed by the radiant heat of the sun—with the monotonous, close, humid air of crowded rooms, heated with steam-coils, it becomes evident, he said, what must be avoided in domestic heating and ventilation. For the mild, humid, and changeable weather of England, the radiant heat of a fire is far the most preferable form of domestic heating; and the smoke-producing coal-fire can be replaced by smokeless fuel, gas, coke, &c. The late Prof. Vernon Harcourt contrived coke-fire places, with hinged draw-plates above to ensure adequate draught and prevent the escape of fumes,

He arranged to light the coke-fire in the middle, so that it burnt downwards as well as upwards. By such simple means, he obtained excellent results, and avoided all the unpleasant features which arise from the escape of fumes—an escape due to the coke-fire making far less draught than the coal-fire. The modern gas-fire is an extremely efficient source of radiant heat. It can be built in the wall, saving much space and economizing building. It is most necessary that it should be constructed so that no fumes escape into the room; and the tap should be arranged so that two, four, six, eight, &c., radiants can be in action at will. A gas-fire should not be turned-down, but two, four, or more radiants put out of action. As a rule, he finds rooms are seriously over-heated by the gas-fires installed without such adequate control.

Heating by fires, as at present arranged, stated witness, is obviously unsuitable for school and work rooms where people are fixed too near or too far from the source of radiant heat. Gas-fires of spherical form might be installed, with work-tables arranged in a circle round them; so that all the workers equally shared in the radiation, and any worker could screen himself and be cool if he pleased. Such fires, with provision for ventilation of cool air, would give very healthy and invigorating conditions. Men who work in smithies and other places, with radiant heat and big openings in the wall and roofs, admitting plenty of cool air, are singularly healthy. Central heating by steam or hot-water coils, on the other hand, unless very carefully controlled, results in humid warm air and enervating conditions. Thermostats should be used to keep the heat from rising above 60° to 63° Fahr. In America, a temperature of 10° Fahr. higher is comfortable, because the cold outside air becomes very dry when heated. The dry air cools the body by evaporation. In this country, over-humidity and stillness of the warm air is the trouble. Draughtless houses with well-fitting doors and windows and central heating, *plus* the traditional fear of cold, must enhance the enervating effect of city life, unless the young are educated in the discipline of daily open-air exercise.

Mr. E. D. SIMON: As to ventilation with gas-fires, with the smaller flues you would get a smaller amount of ventilation?

Witness: I think a normally installed gas-fire would give an adequate amount of ventilation. When one talks about ventilating a room, it depends upon how many people are in the room, and things of that kind.

Sir JOHN LITHIBY: You think there would be no more risk of injury to health by using a gas-fire than there is now with a coal-fire?

Witness: I think a gas-fire, properly installed and working efficiently, is quite a good substitute for the coal-fire.

Bailie SMITH: Would you recommend a central heating system?

Witness: Well, if a central heating system were adopted, some method of radiant heating should also certainly be installed. Every house should have some radiant fire provided in it. Gas should be used for cooking. We should be prepared to give up a great deal to obtain a smokeless atmosphere.

WHAT IS BEING DONE IN BIRMINGHAM.

Mr. R. J. ROGERS, Fittings Superintendent to the Birmingham Corporation Gas Department, placed before the Committee some statistics relating to the use in his city of gas appliances for domestic purposes. He said that at the present time there are in use in Birmingham approximately 150,000 gas-cookers and 65,000 gas-fires, in addition to many thousands of gas-heated water appliances—such as geysers and circulators. Out of 103,000 slot-meter consumers (who represent the general working-class community of the city) 98,000 use gas-cookers, representing approximately 95 p.ct. There are also 6000 gas-fires fitted in the homes of the users of penny-in-the-slot meters During the past ten years, the consumption of gas by automatic meters has increased in Birmingham from 848,500,000 c.ft., representing 12 p.ct. of the total gas output, to 2,555,000,000 c.ft., or 22½ p.ct. of the total output. The average consumption of gas by slot-meter users during the twelve months ended Lady Day this year was 24,880 c.ft. The Corporation have been fixing gas-cookers for the last twenty years; and the use of these appliances has steadily increased. They are advocating that in the living-rooms of new houses a coal or coke range (at the back of which would be the boiler) should be fitted, and in the scullery a gas-cooker and a gas wash-boiler, with a position for a gas-iron. The Gas Department were also suggesting that gas-fires should be fitted in parlours and bedrooms, and that there should be gas-fire grates built with special flues, so that it should be really impossible for the tenant to use coal in the parlour or bedrooms.

The CHAIRMAN: You would like to forbid coal-grates in bedrooms?

Witness: Yes. At the present time we have 60,000 gas-fires installed in Birmingham which are standing in front of coal-grates; and my view is that if coal-grates are adopted for new housing schemes, very shortly they will be covered over by a gas-fire which would be more or less makeshift, and not so good a job as if gas were decided upon in the first instance. Further, it is a waste of money to put in these coal-grates.

Details were submitted by Mr. Rogers of the cost of gas in houses occupied by middle-class people who use gas almost exclusively for all purposes of lighting and heating. There are, he stated, many houses in the area of supply of the Birmingham Gas Department which are fitted up as all-gas houses—no coal or other fuel being used. In considering the cost of gas for running such houses, in all cases note must be taken of what the average daily routine consists of in each house, and also the number of persons concerned. It is found from experience that the average daily gas consumption varies in every house according to these circumstances. In houses where there are three or four adults, where hot baths are required for each person every morning, and where lunch and dinner have to be prepared, and various rooms used, the cost of gas will necessarily be higher than in other houses where there may only be a married couple and one child, and where the cooking and rooms used do not amount to so much. In short, in all estimates of gas consumption, the size of the family and the mode of living must be taken into account. To take an actual case of a servantless house of £35 per annum rental, containing two persons with only two children, the consumption of gas for cooking, breakfast, lunch, tea, and supper, and for washing-up purposes, with a careful housewife, need not amount to more than 120 c.ft. per day. In addition, the gas washing-boiler would be used (say) once a week for washing purposes; and this should not amount to more than 80 c.ft. With regard to the warming of the house, the cost of this necessarily varies with the atmospheric conditions; but he gave figures showing approximately the consumption of gas during the summer and winter months. There would also be the consumption of gas by a geyser in the bathroom, which might be taken as 160 c.ft. per week. Gas for lighting has not been taken into account in connection with the figures, which showed that during the summer six months the average daily consumption of gas would amount to (say) 250 c.ft., which, with gas selling at 3s. 6d. per 1000 c.ft., equals 10½d. During the winter six months the average daily consumption would amount to 625 c.ft.; and, with gas at 3s. 6d. per 1000 cubic ft., the cost would be 2s. 2½d. per day. On this basis, the gas account for the two summer quarters would amount to £3 7s. 4d. per quarter, and for the two winter quarters to £10 1s. per quarter. These figures are confirmed by actual gas accounts of consumers in the Birmingham area of supply in whose houses gas is the only fuel used for cooking and heating. He then quoted a number of records of actual gas consumption in houses where gas is used for all purposes of lighting, heating, cooking, and hot-water supply, showing that the consumption of gas varies in different households, even when the same number of people are to be catered for, owing to the different habits of the occupants of the house.

In connection with the gas equipment for housing schemes, continued witness, too much emphasis cannot be laid upon the necessity of gas supply-pipes of adequate size being laid while the houses are being built. He drew the attention of the Committee to the specification to which all new houses in Birmingham are required by the Gas Department to be fitted. This sets forth that the position for the meter must be approved by the Fittings Superintendent. A place should be arranged for it if possible on the front wall of the building. The rising-pipe from the meter should be of ¾-in. bore iron gas-tube (for the ordinary six-roomed dwelling). The ¾-in. pipe from the meter should be continued under the floors of bedrooms, &c., dropping in the scullery to the cooker position. From this ¾-in. pipe, ½-in. branches should be taken to the bedroom fireplaces for gas-fires. A section of the floor-boards should be left screwed-down, so that the subsequent work of connecting the gas-fire may be carried out without damaging the floor. No horizontal pipes under floors should be less than ½-in. diameter bore. This ½-in. pipe has been found necessary in practice, if the installation is to give satisfaction over a number of years. The pipes rising or dropping to bracket positions should preferably be of ⅜-in. bore. Circumstances may at times warrant the use of ¼-in. pipes.

Bailie SMITH: Too much emphasis cannot be laid on gas supply-pipes of adequate size being laid while the houses are being built. Are your department experiencing any difficulty with regard to the mains in the streets being inadequate?

Witness: Our system of high-pressure gas distribution enables us to supply the demands for gas on the fringe of the district. Mains are, of course, increased in size as required.

Sir JOHN LITHIBY: Do you think, if suddenly a large demand were to come along for gas-fires in provincial towns generally, that the undertakings would be able to supply sufficient gas? Supposing there were legislation requiring coal-fires to cease within a given period, then in the meantime people would have to seek other means of heating, and there would be a great demand for gas-fires?

Witness: There might be a temporary shortage with some undertakings which are now getting towards their maximum output; but this could be very quickly remedied. Gas undertakings possess the greatest flexibility. In Birmingham alone a short cold spell means as much as 3 million c.ft. per day increase; and we are able to respond to it.

Sir JOHN LITHIBY: Do you suggest that any greater statutory facilities will have to be given to gas undertakings?

Witness: I do; particularly with regard to gas supply-pipes in houses. If this Committee, or the Ministry of Health, advocates the extended use of gas-fires, it is, in my opinion, absolutely necessary that all gas undertakings should have statutory powers to see that gas-pipes of adequate size are provided. Otherwise, dissatisfaction and discomfort are bound to be experienced by users of gas-fires.

The CHAIRMAN: Do you apply the profits to relieving the rates?

Witness: That has been the policy in the past; but for last year nothing has been given.

Mr. SIMON: Can you give any comparison of the cost of cooking by gas and by coal?

Witness: I should say gas was cheaper than coal, confining it to the oven only; but for boiling water on a hot-plate, it would be dearer.

Mr. SIMON: Have you any evidence as to whether the smaller flues suggested for gas-fires would give sufficient ventilation?

Witness: The question of these flues is of the utmost importance. The gas-fire flue should terminate in the open air.

Gas-Works Purchase Suggested at Wolverhampton.—At the last meeting of the Wolverhampton Town Council, the question of the purchase of the gas undertaking by the Corporation was mentioned; and it was suggested that a Special Committee should be appointed to go into it. The matter was, however, deferred until the next meeting.

New Carbonizing Plant for Todmorden.—The Todmorden Town Council have accepted the tender of Messrs. Drakes, Ltd., to provide both materials and work for new vertical retort carbonizing plant of a million c.ft. per day capacity for the gas-works, for the sum of £67,675; and the Council are to apply for sanction to borrow £74,450 to cover the cost of the plant and 10 p.ct. for contingencies. The existing plant is over twenty years old, and out of date. Up to the outbreak of the war, the gas consumption of the borough was increasing every year; but it decreased during the war owing to coal and other difficulties. During the past twelve months, the regular statements have shown that the consumption is again increasing, and likely to continue to do so—especially for cooking and other household uses. On several days last winter the demand was greater than the works were able to produce. The existing plant can make only 700,000 to 800,000 c.ft. per day, when both the coal-gas and water-gas apparatus are working at highest pressure.

WAGES AND CONDITIONS OF GAS WORKERS.

The Federation and a Strike Ballot.

On Wednesday evening of last week a statement was issued by the National Federation of General Workers which revealed a critical position in the gas industry throughout the country on the questions of increased wages, annual holidays, and week-end and overtime rates.

A deadlock having arisen in connection with the questions named, a national conference of the workers' section of the Industrial Council for the industry with representatives of the Regional Councils was held to consider the position. The employers made an offer of an annual holiday of one week and certain overtime rates; but at a separate meeting of the workers' section it was decided that acceptance of the offer could not be recommended. It was, however, proposed, with a view to a settlement, that the original demands should be modified to the extent of a minimum of twelve days' holiday per annum with pay, including Christmas Day, Good Friday, and proclaimed National Holidays, instead of fourteen days. The conference was called to receive the employers' reply.

The statement of the National Federation of General Workers referred to was in the following terms:

> The Joint Industrial Council for the Gas Industry have had before them for some time an application from the representatives of the trade unions in respect to annual holidays and week-end and overtime; and the employers have given a final offer in settlement of this question, which applies only to gas undertakings with an output of over 50 million c.ft. per annum. On the top of this the National Federation of General Workers, at the request of the affiliated unions concerned, sent to the Federation of Gas Employers a week ago an application for an all-round general increase of 10s. per week on existing wages rates.
>
> A letter was received from the employers stating that it had been unanimously resolved that, having regard to the financial position of the gas industry, the Federation of Gas Employers were unable to pay the increase demanded. This reply was discussed by the workers' representatives of the Industrial Council; and they passed the following resolution:
>
> "That a copy of the original application respecting wages, annual holidays, and week-end and overtime rates, together with the employers' decisions with respect to each, be sent to the executives of the affiliated unions concerned, with the recommendation that the unions agree to an immediate ballot of their members on the question of whether they are prepared to tender notices in support of our proposals.
>
> "That the executives of the unions be asked to give their decision within six days; and in the event of the unions' decision being favourable to the tender of notices, the National Federation of General Workers be requested to issue a uniform ballot paper to the affiliated unions at once. The result of the ballot to be notified to the National Federation of General Workers, and the pooled vote of the unions to be declared from the federation offices."

The dispute is stated to affect 154 municipal corporations, 110 urban district councils, 961 private companies, 68 factories producing their own gas, and approximately 100,000 workmen. The unions contend that the unskilled gas employees are from 6s. to 10s. behind similarly-rated workpeople in the engineering and shipbuilding trades, while the skilled workmen in gas undertakings are paid on an equality with the engineering and shipbuilding trades.

It was announced on Friday that the employers and the Ministry of Labour had been informed of the crisis in the gas industry of the country; but no proposal had so far been made for re-opening negotiations. No action in regard to the issue of ballot papers will be taken before to-morrow [Wednesday], pending replies from the executives of the eight unions involved. The following is the full demand of the gas-workers:

A 44-hour week (now 47 hours).
Double time for week-ends, Sundays, and Bank holidays.
Fourteen days' annual holiday, excluding Christmas Day and Good Friday, all to be paid for *pro rata*.
Ten shillings a week immediate advance in wages.

They contend that the cost of living has increased 16½ p.ct. since the last award. The employers have replied that the financial position of the gas industry will not permit of the wages demand being granted. They have made an offer in regard to holidays and overtime rates conditionally.

ROTHERHAM GAS UNDERTAKING.

The annual report of the Rotherham municipal gas undertaking, issued by the Engineer and Manager (Mr. J. S. Naylor), states that for the year ended March 31 the quantity of coal carbonized was 23,113 tons, at a cost of £30,641, or 26s. 6·16d. per ton, against 24,680 tons last year, costing £28,870, or 23s. 4·75d. per ton—a decrease of 1567 tons, at an increase of £1771 respectively.

In the twelve months, the quantity of gas made was 301,004,000 c.ft., against 324,659,000 c.ft. the previous year—a decrease of 23,655,000 c.ft. This decrease was accounted for by the closing-down of National Shell Factories and an increased supply of coke-oven gas from Messrs. John Brown & Co., Ltd. The gas made per ton of coal carbonized was 13,023 c.ft., as against 13,154 c.ft.—a decrease of 131 c.ft. per ton. The quantity of gas sold was 288,841,000 c.ft., as against 306,703,000 c.ft. —a decrease of 17,862,000 c.ft. This was due to the closing-down of the National Shell Factories, and also to the fact that Rawmarsh was supplied during part of the year 1918-19 with gas following an explosion. The gas unaccounted for was 37,317,000 c.ft., or 11·25 p.ct. of the make, as against 38,703,000 c.ft., or 11·05 p.ct., last year—an increase of 0·20 p.ct. The illuminating power during the year had been of uniform quality, and the impurities had been kept low. The works and plant had been maintained in good repair and in thorough working order out of the year's revenue. The cost of public lighting in the borough, including wages and maintenance of lamps, amounted to £6507, compared with £2585 last year—an increase of £3922. The gross profit amounted to £10,485, as against £10,809 last year—a decrease of £324. The net profit, after allowing for interest redemption instalments and contributions to sinking funds, amounted to £401, as against £871—a decrease of £470.

SOUTHEND CORPORATION AND THE GAS SUPPLY.

The Gas Committee of the Southend Corporation state that they have considered the report upon the Leigh gas undertaking, prepared by Mr. Arthur Valon, in which he expresses the opinion that it would be impossible to meet the probable future demands for gas from the existing works for more than a few years, and that in all likelihood it would not, in any case, be possible to postpone the construction of new works for more than two years. He recommended that the Council should take immediate steps to acquire a new site and to prepare the plans in readiness for the future construction of works. The Town Clerk reported that, in view of Mr. Valon's suggestion that a piece of land about a quarter-of-a-mile west of the existing gas-works would be very convenient for the erection of works, he had been in communication with the owners, and had received a reply that they were not prepared to part with the land for the purpose mentioned.

The Committee being of opinion that no extensions (other than those immediately required to meet the present demand) should be made to the gas-works in their present position, inasmuch as they consider that the time has arrived when the gas-works should be removed from the sea front, and having regard to the contents of Mr. Valon's report, resolved to recommend—"That, in view of the extraordinary demand which will, in all probability, be made upon the Leigh and Southend Gas-Works in the future, the Council should appoint a Special Committee for the purpose of considering generally the question of the gas supply to the whole of the borough."

CHEAP GAS AT WALKER AND WALLSEND.

The Walker and Wallsend Union Gas Company are in the fortunate position of being able to make a highly pleasing announcement to their consumers.

Before the war the price of gas was 2s. 5d. per 1000 c.ft., and it was only raised 4d., to 2s. 9d. per 1000 c.ft., during the war. This was the price at December last. Now, owing to the favourable condition of the accounts—the main factor being the high shipping prices being obtained for coke—the Directors have seen their way to reduce the price 9d. per 1000 c.ft., as from Jan. 1 of this year—the charge being thus 5d. per 1000 c.ft. below pre-war. The effect to household and domestic consumers is:

Gas 2s. per 1000 c.ft., less 5 p.ct.	1s. 10·8d.
Coal rebate at 1s. per 1000 c.ft. for the quarter . .	1 0
Net charge per 1000 c.ft.	0s. 10·8d.

FIRE-CLAY REFRACTORIES.

Mr. P. S. Devereux (in the absence, through illness, of Mr. W. J. Rees, of the University of Sheffield) recently read a paper, on "Fire Clay Refractories," before the members of the Birmingham Metallurgical Society. Mr. Devereux, who is a co-worker with Dr. Mellor, said it was commonly supposed that the addition of silica to a fire-clay makes it more refractory, when, as a matter of fact, the softening point was lowered.

Chromite bricks, made from chrome iron ore, are used for various purposes. Their low conductivity of heat is their chief attribute; this not diminishing even at high temperature. An ore running from 40 to 50 p.ct. chromic oxide, and from 3 to 7 p.ct. silica, makes the best refractory. Bauxite and alumina bricks have not had a fair chance. While resistant to slags, they must be prevented from shrinkage by high firing first. The great trouble with magnesite bricks is their tendency to crack, flake, and spall at high temperatures. Magnesia from calcined magnesite occurs in two different forms, one of which has a lower specific gravity of 3·2, and is more chemically active, than the other form with a specific gravity of 3·7. There was thus a shrinkage caused by this change from low to high specific gravity. This should be effected in making the bricks; but the conversion is never complete, even if the firing is continued well over 1650° C.

Mr. Devereux urged that, with regard to the testing of refractory materials, it is important that the methods be standardized. A provisional specification has been prepared by a Committee of the Refractories Section of the Ceramic Society. Perfect adaptation of the refractory to furnace conditions of temperature, pressure, chemical action, and mechanical abrasion is one of the big problems whose successful solution would constitute a great contribution to the fuel conservation movement. A good arrangement would be, where practicable, to cover the outside of the furnace with a good thermal insulator, so as to retain the heat in the furnace. Fuel would thus be greatly conserved.

Messrs. Thomas Glover & Co., Ltd., have opened a new meter-repairing shop at Earl Street, Bristol, where stocks of new meters are also kept. Mr. A. F. Wightman, after a period of twenty-eight years' service, has been appointed to represent the firm in the West of England and South Wales.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 26.

The London market remains in a strong position, especially for pitch, which is reported to have been sold for this and next season's shipment at fully 140s. net per ton f.o.b. makers' works. Creosote is worth 1s. 1d. to 1s. 1½d. net per gallon in bulk. There is considerable inquiry for naphthalene of different grades. Sixties crude carbolic acid, benzol, toluol, and solvent naphtha are all unchanged.

There is nothing fresh to report about sulphate of ammonia for the home agricultural trade.

Tar Products in the Provinces.

April 26.

The average values for gas-works products during the week were: Gas-works coal tar, 80s. to 85s. Pitch, East Coast, 122s. 6d. to 130s. per ton f.a.s.; West Coast—Manchester, 120s. to 125s.; Liverpool, 120s. to 125s.; Clyde, 125s. to 130s. nominal. Benzol 90 p.ct. North, 2s. 3d. to 2s. 4d.; crude 65 p.ct. at 120° C., 1s. 5d. to 1s. 7d. naked at makers' works; 50-90 p.ct. naked, North, 2s. 2d. to 2s. 4d. Toluol, naked, North, 2s. 6d. to 2s. 7d. nominal. Coal tar crude naphtha in bulk, North, 11½d. to 1s. Solvent naphtha, naked, North, 3s. 3d. to 3s. 4d. Heavy naphtha, North, 3s. 4d. to 3s. 6d. Creosote, in bulk, North, liquid, 11½d. to 11½d.; salty, 7d. to 7½d. Heavy oils, in bulk, North, 11½d. to 1s. Carbolic acid, 60 p.ct., 3s. 8d. to 3s. 10d. Naphthalene, £30 to £35; salts, £8 10s. to £9 10s., bags included. Anthracene, "A" quality, 8d. to 9d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

Markets continue very strong, and the tendency of values is still upward. Business is much hampered by shortage of railway wagons. This is particularly the case with pitch. The demand for this material is strong; and while users are fairly well placed at the moment and are not much interested in prompt deliveries, makers are not offering forward, although consumers are willing to pay more. With the advent of the warm weather, exports in bulk will soon become too risky; and the trade will have to depend largely on business from South Wales. Whether, during the period of reduced shipments, prices will be maintained is open to question; but there seems a fair amount of confidence in the future. Creosote is reported to be slightly easier, although quotations do not bear this out. The dearer outlook for coal has again suggested the use of liquid fuel on long distance railway journeys. If adopted, this would be in favour of creosote. Carbolic acid is unchanged, except that crystals cannot be had for prompt delivery. Cresylic acid is a shade dearer. Solvent naphtha is quietly steady. Benzol remains unaltered, but is going into consumption rapidly. Petrol is expected to be dearer shortly, and the advantage will all the time be with benzol. Intermediate products continue in active request. A few shipments from America are noted; but they have been readily absorbed. Makers, both here and in the States, are sold up for months ahead.

Latest quotations are as follows:

Benzol: 90% London 2s. 4d. to 2s. 5d., North 2s. 3d. to 2s. 4d.; 50-90% 2s. 2d. to 2s. 3d. London, 2s. 1d. to 2s. 2d. North; crude 60-65%, 1s. 5d. to 1s. 7d.; pure, 3s. per gallon naked.

Crude Tar: London, 72s. 6d. to 77s. 6d.; Midlands, 70s. to 72s. 6d.; North, 70s. to 75s. per ton *ex* works. Refined tar, 50s. per barrel (free) on rail.

Pitch: London, 130s. per ton; East Coast, 125s. to 130s. per ton; West Coast, 115s. to 130s., with Manchester 125s. per ton, and Glasgow 120s. per ton; South Wales, 140s. per ton.

Solvent Naphtha: London, 3s. 4d. Provinces average 3s. 2d. per gallon.

Crude Naphtha: Naked, 10d.; North, 9d. per gallon.

Heavy Naphtha: 3s. 2d. per gallon.

Naphthalene: Refined, £33 per ton nominal; crude, £13 to £18, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d. Pure, 3s.

Creosote: London, 1s. 0½d. to 1s. 1d.; North, 1s.; heavy oil, 10½d. per gallon in bulk.

Anthracene: 40-45%, 9d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 5d. to 1s. 6d. per lb., drums extra.

Aniline Salts: 1s. 10d. to 2s. per lb.

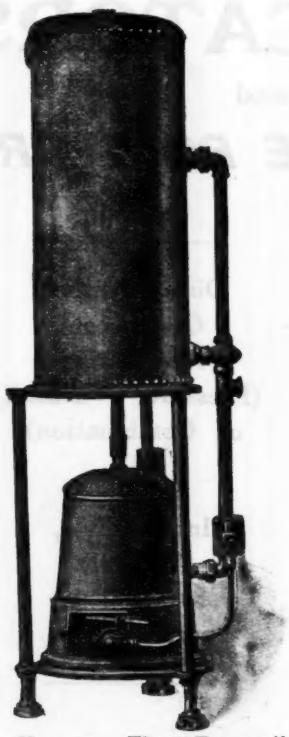
Cresylic Acid: 95%, 4s. 3d. to 4s. 6d.; 97-99%, 4s. 6d. to 4s. 9d. per gallon *ex* works London, f.o.b. other ports.

Carbolic Acid: Crude 60%, 4s. per gallon; crystals 40%, 1s. 3d. to 1s. 4d. per lb.

Salicylic Acid: Technical, 3s. 4d. to 3s. 8d.; B.P., 3s. 9d. per lb.

Sulphate of Ammonia.

This material is still selling readily at the fixed price; but with the coming of the end of May, when the season finishes, much more interest is being shown in the foreign demand, especially as the export price is some £15 more than for home use. Latest advices from America indicate a slightly easier tendency, with no pressure on the part of foreign buyers. Buying by Japan has fallen off considerably; but if inquiries are any guide this is purely a temporary phase. Limited quantities have been sent to South America, but have had no effect on the general market.



No. 424. The "Energy."
Stands can be supplied to any desired height.

The "Main"
Circulating Water Heater.

THIS Gas Heater is constructed throughout of strong cast iron with corrugated inner and outer jackets giving an unprecedented heating surface. The gases, after heating the inner jacket, are drawn to the base, and to reach the flue outlet must travel over the outer casing, thus utilising the heat to the utmost.

A really efficient thermostat is fitted; and the heat-retaining outside casing is made of steel, porcelain enamelled, giving the heater a most attractive appearance.

A sample will convince you of its efficiency.

R. & A. MAIN, LTD.

WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 6, Narrow Wine Street, BRISTOL; 333, Queen Street, MELBOURNE.

Sale of Colchester Gas Shares.—By a coincidence, on the afternoon of the meeting of the Eastern Counties Gas Managers' Association, there was a sale of shares in the Colchester Gas Company. This went off very well; £4000 of ordinary shares being disposed of readily at a little below par. They are 7 p.ct. standard dividend shares, now receiving 5¼ p.ct. under the Temporary Increase of Charges Act.

Gas Consumption at Blackpool.—For the municipal year just ended, the night supply of gas at the Blackpool Gas-Works was 277,692,000 c.ft., and the daytime supply 489,768 c.ft.—a total of 767,460,000 c.ft. These show respective increases on 1919 of 13,978,000, 30,394,000, and 44,372,000 c.ft. For the period of April 1 to 21 this year, the night output was 15,307,000 c.ft., an increase of 1,822,000; and day output, 27,760,000 c.ft., an increase of 3,948,000 c.ft.

Ireland's Coal Shortage.—Day by day Ireland's coal shortage crisis becomes more acute, and, in addition to gas-works in some of the smaller towns already closed-down, there is apprehension that action in the same direction may have to be taken in some of the larger centres. The Cork Electric Tramway and Lighting Company announce that their tramway service may have to be suspended, and that the supply to Queenstown will cease. Various industries are seriously affected.

Lighting of Oakengates.—At the annual meeting of the Urban District Council of Oakengates, it was proposed that a Committee be appointed for the purpose of inquiring into methods of public and private lighting of the district other than by gas. The mover said that the proposition had been rendered necessary by the action of the Oakengates Gas Company, in reference to the housing schemes in hand by the Council. In connection with one scheme, the Gas Company refused to lay any mains; and though they had since modified their position to some extent, the fact remained that they were not prepared to lay gas-mains as the Council required. It was now decided to see by what other method the district could be lighted. The Committee was appointed.

Proposed Extensions at Danish Gas-Works.—A report from H.M. Commercial Secretary at Copenhagen, published in the "Board of Trade Journal," states that certain schemes of development are under consideration by Danish gas-works. A party of officials of the Copenhagen Municipality have recently visited Sweden, with a view to examine the most recent works carried out there in respect of gas-plant systems. According to the "National Tidende," this Commission have returned, after examining gas-works at Helsingborg, Gothenburg, and Stockholm, where there are modern British gas-generating systems, and also some German plants. The visit was of considerable interest, in view of the proposal to ask the Municipality to vote a sum of 11,000,000 kroner for the extension of the Valby Gas-Works, and a gas-pumping station there with a pressure system carried under the harbour to Sundby, the cost of which is estimated at 3,000,000 kroner. The article states that the proposal now put forward is based on the adoption of the West system.

Gas-Works Inquiry at Bingley.—A Ministry of Health inquiry was held at Bingley, last Tuesday, by Major J. Stewart, R.E., into an application by the District Council for sanction to borrow £3739 for gas-works purposes. No opposition was offered.

Newry Gas Lighting.—At a meeting of the Newry Urban Council, Mr. Connellan complained that the public lighting was disgracefully restricted, and that frequently people were groping about in utter darkness. Mr. Kerr said this state of things was due to the fact that the Gas Committee could not get coal and had to conserve as best they could. The manager of the works had been ordered to curtail the supply in the meantime in order to save the town from darkness altogether.

Claim for Allowance under the Finance Act, 1919.—The Edinburgh and Leith Gas Commissioners have had under consideration the question of claiming an allowance under section 18 of the Finance Act, 1919, in respect of buildings, &c., at the gas-works; and some little time ago a Sub-Committee had an interview with the local Inspector of Taxes, who subsequently inspected the works. As his views were not considered satisfactory, a communication was sent to the National Gas Council suggesting that that body might take the matter up on behalf of the gas industry. They did not, however, see their way to fall in with the suggestion, and recommended that the Commissioners should deal with the question themselves. The Commissioners have now instructed the Clerk to prepare and submit to counsel a memorial for his opinion as to how the Commissioners' claim should be stated.

Nottingham Gas Accountancy.—Proposals submitted by the Gas Committee at the last regular meeting of the Nottingham Corporation, relative to future arrangements in the Accountant's Department, consequent on the retirement of Mr. William Garton, led to considerable debate. The Committee had recommended that Mr. Garton should receive an allowance of £500 per annum, as Consulting Accountant, and that Mr. R. H. Mason, his Chief Assistant, should be appointed to fill the vacancy at £500 a year for six months, and afterwards permanently, provided his services were found satisfactory. Opposition emanated from the Labour party. Mr. W. Halls moved the reference back of the report; that a Sub-Committee should be appointed to consider the advisability of placing the whole of the accounts of the gas undertaking under the City Treasurer's Department; and that the Sub-Committee should also deal with the question of the amount of Mr. Garton's retiring allowance. Alderman A. Ball (the Chairman of the Gas Committee) said it would be beneath any member of the Council to discuss the allowance to be made to a man who had reached the age of over 86 years, who had never been paid what his services were really worth, and who could have retired 25 years ago on two-thirds of his salary. The amendment was defeated by a small majority. Ultimately it was determined to refer the question of the retiring allowance to the Salaries Committee; Alderman Ball declaring that if the Committee did not grant Mr. Garton the £500, he would make it up himself.

USE Simmance's

DEAD BEAT INDICATORS

instead of WATER-TUBE GAUGES and

"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.

Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, for foul or purified gas.

MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.

Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

Mr. F. W. Bridges.

Those who were in any way connected with the gas exhibition at Earl's Court some sixteen years ago, and the subsequent one at Shepherd's Bush towards the end of 1913, will remember the hard and good work that was done by Mr. F. W. Bridges. When he promoted the first-mentioned one in 1904 he was new to the business. But his ability to organize at once showed itself; and since then he has carried through successful exhibitions having for their object the further development of many different branches of industry. People who have known Mr. Bridges all these years feel that time has dealt gently with him; but with the extension of the business, and having in mind the desirability of securing continuity, he is taking into partnership two sons—Mr. Frederick H. Bridges and Mr. Kenneth W. Bridges—and the occasion was celebrated last Wednesday by a dinner at the Connaught Rooms, Great Queen Street, when a party of over a hundred sat down, with Mr. F. W. Bridges in the chair. The speakers included Dr. R. S. Hele-Shaw, F.R.S., M.Inst.C.E., Mr. F. W. Goodenough, Colonel R. Saxton White, V.D., Mr. W. H. Patchell, M.Inst.C.E., Dr. W. R. Bisschop (from Holland), and Captain H. Riall Sankey, C.B. Many were the expressions of goodwill towards Mr. Bridges; and earnest were the wishes for the continued success of the firm under its new constitution. It is evident that, in the useful work he has so long been doing—the value of which was generously acknowledged—Mr. Bridges has made a host of friends; and this friendship will doubtless be extended to his sons, in their efforts to assist British trade. Speaking of the value of exhibitions generally, Dr. Bisschop remarked that he never thought they were intended to show direct results; but he challenged anybody to say that the indirect results were not greater than could be secured by other forms of publicity.

More Vertical Retorts for St. Helens.—There was an inquiry at St. Helens last Tuesday, by Mr. H. H. Hooper, on behalf of the Ministry of Health, regarding an application for sanction to borrow £67,500 for the purpose of extending the producing capacity of the gas-works. At present the works have 44 vertical retorts and 126 horizontal retorts. It is proposed to do away with the latter, and have 48 vertical retorts in their place. This would increase the daily make of gas by a million c.ft.

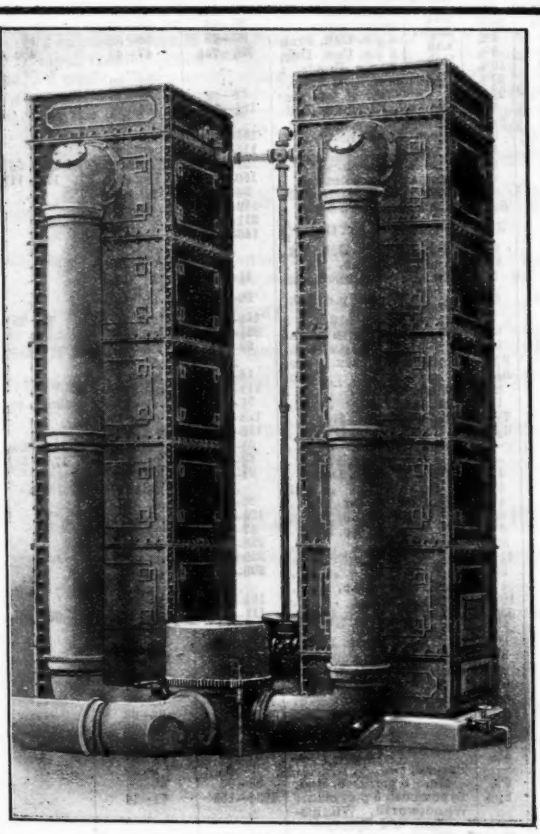
Nottingham and Ex-Service Men.—A great deal of criticism having been forthcoming in Nottingham lately as to the failure to recognize their work by affording employment to ex-service men, it was shown at the last meeting of the Corporation that the Gas Department have adequately fulfilled their responsibilities in the matter; the Chairman of the Committee stating that, out of 854 employed, 300 were ex-service men. The Council adopted a resolution, in terms suggested by the Burnley Corporation, calling upon the Government to make provision for discharged and disabled ex-service men who have not so far been absorbed in private industry.

Radiation Ltd.

The report of the Directors which will be submitted at the meeting in Birmingham to-day of Radiation Ltd. states that the balance of revenue account for the period to Dec. 31 last is £111,158. After deducting the interim dividends (£38,485) paid last September, there remains at disposal the sum of £72,673, which the Directors recommend be appropriated as follows: A final dividend of 3 p.ct. to Dec. 31 on the preference shares (less income-tax), £12,366; a final dividend of 3½ p.ct. on the ordinary shares, to Dec. 31 (free of income-tax), £36,566; and carry forward to next year, £23,741. Since the closing of the accounts on Dec. 31, the Directors have made an offer to the preference shareholders of the Wright, Richmond, and Davis Companies, to exchange their shares for preference shares of this Company, on the terms that they should receive in respect of the six months to Dec. 31, in lieu of dividend from their respective Companies, a sum equivalent to a dividend on their new shares in Radiation Ltd.; and practically without exception all these preference shareholders have taken advantage of the offer. A month later, an offer was made to the shareholders of Fletcher, Russell, & Co., Ltd.—both preference and ordinary—to exchange their shares for shares of this Company, and 98·5 p.ct. of the preference shareholders and 98 p.ct. of the ordinary shareholders of that Company have availed themselves of the offer. Under the terms of the offer, this Company have to pay the equivalent of dividend on the shares allotted in exchange for shares of Fletcher, Russell, & Co., Ltd., from the dates to which dividends have been paid by the Fletcher Company on such transferred shares; and this Company will be receiving the dividends on the shares acquired in the Fletcher Company as from the same dates. It was a condition of the agreement entered into for the exchange of the shares in Fletcher, Russell, & Co., Ltd., that Mr. Charles Clare, Mr. W. H. Rudge, and Mr. William Russell become Directors and Managing-Directors of this Company; and a resolution will be submitted as to these appointments.

A manufacturers' representative, established in Melbourne and Perth (Western Australia), desires to secure the representation in Australia of United Kingdom manufacturers of gas-mantles and fittings, including burners suitable for air-gas installation, and similar heating and lighting specialities. [Reference No. 548.] Applications for names and addresses must be sent to the Department of Overseas Trade, No. 35, Old Queen Street, S.W. 1.

The Lord Mayor and City Corporation have granted the use of the Guildhall for a conference of manufacturers on Friday afternoon, May 7, when one of the resolutions submitted will be to request the Prime Minister to set-up a Committee to examine and report as to whether Government Departments which were created during the war as Departments of Control should now in whole, or in part, be closed-down. The chair will be taken by Mr. George Terrell, M.P., the President of the National Union of Manufacturers.



"BEARSCOT" TUBING IN WATER CONDENSERS EXTENDS UPWARDS OF 130 MILES.

WATER-COOLED CONDENSERS

AS FITTED WITH THE **"BEARSCOT"** SAFE JOINT TUBE.

With our Central Port Fourway Valve the Condensers may be Reversed or Bye-passed as Required.

PARTICULARS WILL BE SUPPLIED UPON APPLICATION TO—

R. & J. DEMPSTER, LD.

Telegrams: "Scrubber Manchester"

MANCHESTER.

LONDON OFFICE:
34, VICTORIA STREET, WESTMINSTER, S.W.1.

Proposed Verticals for Perth.—The Town Council of Perth have under consideration the introduction of vertical retorts at an estimated expenditure of £60,000, in preference to renovating the present system at a cost of £15,000. A report from Mr. W. Doig Gibb, who was appointed by the Town Council to advise, recommends the installation of these retorts. The Gas Committee are to make visits of inspection to the gas-works at Uddingston, Hamilton, Greenock, and Helensburgh.

Leicester Gas Department Accounts.—The analysis of the accounts of the Leicester Corporation Gas Department for the year 1919, by Mr. Hubert Pooley (the Engineer and Manager), shows that the capital outstanding was £859,817, being at the rate of £4 15s. 8d. per ton of coal carbonized, or 6s. 11d. per 1000 c.ft. of gas sold. The quantity of coal carbonized was 138,918 tons, and of oil used (coal equivalent) 40,829 tons. The quantity of gas made was 2,567,827,000 c.ft., or 14,286 c.ft. per ton of coal carbonized. The gas unaccounted-for was 3·59 p.ct. The net proceeds of residuals were 55·49 p.ct. of the cost of coal. The net profit on the year's working amounted to £4771, which was allocated to special depreciation, No. 1 section, Aylestone Road works.

Youghal Gas Undertaking.—The Youghal Urban Council having received a report from the Gas Manager to the effect that the only available holder was in a bad state of repair, and was losing a quantity of gas, and that a new one would cost about £4000, a Committee appointed to investigate the matter recommended that the existing holder and mains should be thoroughly repaired, and the cost taken out of surplus revenue; and that to provide this the price of gas should be raised to 7s. 11d. per 1000 c.ft.

Manchester and the Stretford Gas-Works.—Negotiations between the Manchester Corporation and the Stretford Gas Company have, says the "Manchester Guardian," now been in progress for some time with a view to the transfer of the undertaking to the city. The shareholders are to decide at the meeting on May 5 whether or not to accept an offer of purchase by the Manchester Corporation. The purchase price is stated to be £285,000. Already the supply of Stretford's water is in the hands of the city; but proposals for the amalgamation of Stretford with the city have been so far resisted. Owing largely to the great industrial development of Trafford Park, Stretford has of late years greatly increased its population and rateable value.

STOCK MARKET REPORT.

The Stock Exchange has had a quiet week; the volume of business being considerably restricted by various causes. Prices in general were not very quick to find their new level in the face of a 7 p.ct. Bank rate; and then there were the doubts and fears engendered by the Chancellor's manifold aggressive schemes directed against industrial capital. Not the least resented is the inequitable singling-out of joint-stock undertakings for a corporation tax. Thus the general tone was mostly dull.

The gilt-edged market, however, did fairly well. Home Government issues were firmer, except War Loan, which touched on Tuesday the record low figure of 85¾, but recovered later. Friday's prices were: Consols, 46⅞-47⅛, War Loan 86½-87, Funding 69½-69¾, Victory 76-76½. Corporation new issues were in request.

Home Rails were dull; but the last prices, especially for prior charges, were steadier. Canadians were quite easy, while Argentines fluctuated.

The Foreign Market was depressed. French Loans were weak, and were not helped by San Remo puzzles; but Belgian were firm.

The Miscellaneous Market was in poor case; firm spots being scarce. Rubbers and Oils were both weaker.

Business in the Gas Market was very limited, and what was marked was almost confined to the three largest companies. The general tone was dull. In the London group, Gaslight ordinary was down as low as 49; and the quotation fell 2. The other issues were unchanged. South Metropolitan touched 50, and the quotation was lowered 3. In Suburban and Provincial, British was ½ better; but Ilford debenture fell 2. Imperial Continental changed hands at lower figures; but the quotation stood. Primitivas were hardly noticed.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 38, 38½, Commercial debenture 45, European 7, Gas Light ordinary 51¼, 52, 53, ditto maximum 38, Primitiva preference 50, South Metropolitan 52, 52½, 53½. On Tuesday, European 7 1/16, Gas Light ordinary 50½, 51, 51½, 52½, ditto maximum 39½, Imperial Continental 116, 117, Primitiva 25s., South Metropolitan 50½, 51¼, 51½, 52. On Wednesday, Brighton and Hove ordinary 80½, 81¼, Croydon "A" 133½, Gas Light ordinary 50½, 51½, ditto maximum 38, ditto debenture 48½, Imperial Continental 116, 117, Primitiva 22s. 6d., South Metropolitan 51½, 52, 52¼. On Thursday, European 7, Gas Light ordinary 50½, 51½, ditto maximum 39½, ditto preference 56, ditto debenture 48½, Ilford debenture 58⅝, 59, Imperial Continental 115, 117, Monte Video 75, 75½, Primitiva debenture (1911) 48, South Metropolitan 50, ditto debenture 47, Kingston-on-Thames 49½. On Friday, Gas Light ordinary 49, 49½, 50, 50½, Imperial Continental 115½, 116, 117½, 118, Primitiva preference 47s. 6d., South Metropolitan 51, Kingston-on-Thames 49¾.

In the Money Market, the supply was at first scarcely equal to the demand, and rates both for short loans and discount were harder. But the position soon relaxed, and easier conditions ruled for the rest of the week. Silver was less agitated and free from wild fluctuation. The Bank rate is 7 p.ct., as fixed on the 15th inst.

The Chairman of the Kirkby-in-Ashfield gas undertaking announces that the loss on the concern has not been so great as was anticipated; and in the course of this year the Committee hoped to place things on a sound business footing.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares.	When last Dividend.	Ante-War Dividend & Bonus. p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
129,049	Stk.	Mar. 11	4	4%	Aldershot 4 p.c. Pref.	..	58—63	..
1,551,868	"	Mar. 26	2½	3⅓%	Alliance & Dublin Ord.	39—34	37—42	38—38½
874,000	"	Jan. 15	4	4%	Do. 4 p.c. Deb.	76—79	61—63	..
280,000	5	Oct. 30	7½	8%	Bombay, Ltd.	5⅞—6⅛	5—5½	..
50,000	10	Feb. 26	16	10%	Bournemouth Gas and Water { 10 p.c.	29—30	8½—9	..
882,110	10	"	7	7%	B 7 p.c.	15—15½	9—10	..
115,000	10	"	6	6%	Pref. 6 p.c.	13½—14	8½—9	..
162,065	—	Dec. 30	—	4%	4 p.c. Deb.	..	64—66	..
992,045	Stk.	Feb. 12	14	80/-	Brentford A Consolid.	351—366	45—50	..
754,920	"	"	11	26/8	Do. B New	304—309	40—45	..
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	70—75	..
221,400	"	Dec. 11	4	4%	Do. 4 p.c. Deb.	91—93	84—86	..
214,775	"	Mar. 11	11	74%	Brighton & Hove Orig.	208—213	121—126	..
344,300	"	"	8	5⅓%	Do. A Ord. Stk.	154—159	80—85	80½—81½
1,287,500	Stk.	Feb. 26	5	5%	Bristol 5 p.c. max.	..	..	..
580,000	20	Apl. 14	12½	10%	British	44—45	24—26*	..
190,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	59—61	..
345,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	47—50	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	7½—7⅞	..
100,000	10	Oct. 30	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—6¾	..
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	..
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	105—110	..	..
1,518,380	"	Feb. 26	5/9/4	33/4	Commercial 4 p.c. Stk.	106—108	54—59	..
560,000	"	"	5½	26/8	Do. 3½ p.c. do.	103—105	48—53	..
475,000	"	Dec. 11	8	8%	Do. 5 p.c. Deb. Stk.	69½—71½	46—49	45
600,000	"	"	4	—	Continental Union Ltd.	76—79	27—32	..
300,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	40—60	..
61,600	Stk.	Feb. 26	14½	104%	Croydon A 10 p.c.	..	130—140	133½
278,408	—	"	11½	7⅔%	Croydon B and C 7 p.c.	..	90—100	..
492,576	Stk.	—	6	5%	Derby Con. Stk.	138—125	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	..	..
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	7—9	7—7 1/16
16,398,975	Stk.	Feb. 12	4/17/4	80/-	Gas Light and Coke { 4 p.c. Ord.	98—102	48—51	49—53
2,600,000	"	"	3½	26/8	3½ p.c. max.	76—79	38—43	38—39½
4,062,335	"	"	4	4%	4 p.c. Con. Pref.	96—99	55—58	56
4,674,850	"	Dec. 11	8	8%	3 p.c. Con. Deb.	73½—74½	47—49	48½
180,000	"	"	10	10%	10 p.c. Bonds	..	..	..
33,500	"	Mar. 11	5	3⅓%	Hastings & St. L. 5 p.c.	..	55—60	..
258,740	"	"	3½	2⅓%	Do. 3½ p.c.	37—38	33—43	..
70,000	10	April 20	11	7%	Hongkong & China, Ltd.	16½—16½	8½—9½	..
95,000	Stk.	Mar. 11	9	6⅔%	Hornsey 7 p.c.	..	88—93	..
131,000	"	"	7½	5⅓%	Ilford A and C.	151—154	86—91	..
65,780	"	"	6½	4⅓%	Do. B	115—118	65—70	..
55,500	"	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	57—60	58½—59
4,940,060	"	May 14	9	4½%	Imperial Continental	158—160	113—120	115—118
1,225,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—88	80—85	..
225,242	"	Mar. 26	6½	5⅓%	Lea Bridge Ord. 5 p.c.	119—121	80—85	..
2,498,986	"	Feb. 26	10	37/6	Liverpool 8 p.c. Ord. A	211—213	..	..
206,088	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	146—148	..	..
165,786	"	Feb. 26	7/5/6	82%	Maidstone 5 p.c.	..	..	..
75,000	5	June 11	5	5%	Malta & Mediterranean	..	52—57	..
350,000	100	Apl. 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	4½—4¾	1½—2½	..
541,220	Stk.	Nov. 27	4	5%	Monte Video, Ltd.	99—101	89—96	..
1,875,292	"	Feb. 26	4½	3⅓%	Newcastle&Gateh'd Con.	11½—12	72—77	75—75½
599,795	"	Dec. 30	3½	3⅓%	Do. 3½ p.c. Deb.	98½—99½	68—65	..
15,000	10	Mar. 11	—	3⅓%	North Middlesex 10 p.c.	89—93	55—57	..
55,940	10	"	7/14/0	6⅔%	" " 7 p.c.	14—15	18—18½	..
300,000	Stk.	Nov. 27	5	5%	Oriental, Ltd.	117—122	8½—9½	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	103—106	..
68,000	50	Mar. 11	13	7⅓%	Portsea, Island B	128—131	4½—5½	..
180,000	50	"	12	6⅔%	Do. C	118—121	66 71	..
249,980	5	April 26	5	—	Primitiva Ord.	5½—6	58—58	..
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4½—5	1—1½	22/6—25/-
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	2½—3½	2½—3½	47/6—50/-
600,000	Stk.	Jan. 29	4	4%	Do. " 1911	91—93	70—72	..
846,128	"	Dec. 30	4	4%	River Plate 4 p.c. Deb.	..	48—51	48
150,000	10	Mar. 26	6	6/-	San Paulo { 6 p.c. Pref.	55—57	47—50	..
125,000	50	Dec. 30	5	5%	5 p.c. Deb.	10½—11	7½—7⅝	..
185,000	Stk.	Mar. 11	10	50/-	Sheffield A	47—49	39—41	..
209,984	"	"	10	4⅓%	Do. B	238—234	68—73	..
528,600	"	"	10	35/5	Do. C	222—224	58—68	..
188,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	220—223	58—63	..
90,000	10	Oct. 15	9	10%	South African	..	..	..
6,609,995	Stk.	Feb. 12	5/4/0	80/-	South Met. 4 p.c. Ord.	10½—11½	12—13	..
250,000	"	Jan. 15	—	5%	Do. Pref.	111—112	48—51	50—53½
1,895,445	"	"	8	8%	Do. 3 p.c. Deb.	..	98—96	..
294,890	"	Feb. 26	3½	3⅓%	South Shields Con. Stk.	72½—74½	47—50	47
1,087,795	"	Aug. 14	5	3⅓%	S'th Suburb'n Ord. 5 p.c.	157—159	108—104	..
247,558	Stk.	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	114—116	64—69	..
647,740	"	Nov. 13	7½	3⅓%	Southampton Ord.	116—118	78—83	..
121,275	"	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	92—122	60—63	..
150,000	"	Aug. 14		3⅓%	Tottenham District { A 5 p.c.	..	61—63	..
789,275	"	"	6	2⅔%	B 3½ p.c.	135—138	68—73	..
181,355	"	Dec. 11	4	4%	4 p.c. Deb.	115—117	48—53	..
189,880	10	Dec. 30	5	—	Tuscan, Ltd.	87—89	61—64	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	5—6	1—2	..
226,476	Stk.	Mar. 11	5	3⅓%	Tynemouth 5 p.c. max.	93—95	45—50	..
80,000	"	Feb. 26	8⅔	55/-	Wandsworth, Wimbledon, and Epsom—	108½—109	72—74	..
256,686	"	"	6⅔	40/-	Wandsworth A 5 p.c.	151—156	83—88	..
108,075	"	"	—	33/6	Do. B 3½ p.c.	129—134	61—66	..
140,866	"	"	—	33/6	Do. C	..	61—66	..
353,000	"	"	5½	33/9	New Ordinary	..	61—66	..
98,000	"	"	6⅔	40/-	Wimbledon 5 p.c.	117—122	63—68	..
88,416	"	Dec. 30	3	3⅓%	Epsom 5 p.c.	121—126	63—68	..
					3 p.c. Deb. Stk.	66—69	48—50	..

* Ex Div.

Gas-Fires and Fresh Air.—The Medical Correspondent of the "Observer," writing on the subject of ventilation, says: The open coal-fire supplies radiant heat; and, like Nature, it ensures movement of the air by the draught up the chimney. On the other hand, it wastes the coal and pollutes the outside air—which is, after all, the source of the inside air—and obstructs the light. The electric radiator provides radiant heat; but it causes no current of air up the chimney, and, since thus it does not ventilate, it is imperfect. Central heating, as by anthracite in New York, for instance—eliminates the abomination of smoke, but it constantly tends to be overdone; and it opposes, instead of providing, ventilation. The gas-stove, with a properly functioning flue, meets every indication of physiological science, providing radiant heat and that movement of the air which alone is ventilation, and which permits of the full respiration that protects the lungs. Central heating has, nevertheless, immense practical advantages in many circumstances.

The Darwen Corporation Gas-Works, for the financial year just closed, show a profit of £6030.

The Directors of the Oriental Gas Company, Ltd., have resolved to pay, on May 31, an interim dividend at the usual rate of 3½ p.ct., less income-tax, on account of the year ending on June 30 next.

The Public Control Committee of the London County Council made arrangements for the daily testing of the gas supplied by the three Metropolitan Companies, which was in force before the war, to be resumed as from the 1st inst.

It is of interest to note that the London County Council Education Committee have sanctioned expenditure, not exceeding £866, for the purchase of gas-cookers, gas-fires, and similar appliances which have been hired from the Gas Light and Coke Company, and installed in various Council schools.

Messrs. R. & A. Main, Ltd., have re-opened their West of England Branch and Showroom at No. 6, Narrow Wine Street, Bristol. Mr. J. J. Pratt, who represented the firm before the war, and has now been demobilized, after four years' service, will represent them in the West of England and South Wales.

The Dunoon Town Council have decided to instal the "A. & M." [Alder and Mackay] patent pressure-wave automatic controllers to the whole of their street gas-lamps, numbering more than four hundred. Leeds are also extending their system by the introduction of a further five hundred "A. & M." controllers.

With the approval of the Commissioner of Police, instructions have been given by the Highways Committee of the London County Council for the lighting on the Thames bridges and embankments of the lamps which were out of use during the war. The Committee have agreed to an application for increased charges in respect of the maintenance of the gas-lamps on Putney and Wandsworth bridges, applied for by the Wandsworth, Wimbledon, and Epsom District Gas-Company.

Alderman H. Rhodes Brown, at a meeting of the York Chamber of Trade last week, in criticizing the Corporation Electricity Department's existing methods and proposed extensions, said York had five municipal trading undertakings, only one of which—the markets—made a profit. The electricity and tramways undertakings showed a loss; and he had no doubt whatever that if the Corporation had taken over the gas undertaking, now controlled by a private Company, the charges would have been double what they actually were to-day.

The coal position at the Blackpool Corporation Gas-Works is serious; and unless there is an improvement shortly, restrictions will have to be imposed on the consumers. Already street lighting is greatly curtailed.

The Highways Committee of the London County Council have accepted the offer of Messrs. E. C. & J. Keay, Ltd., to undertake the heightening of the longitudinal divisions in certain coal-bunkers at the Greenwich power-station for £4599. This is in connection with the adoption of the Nicol patent "Sandwich" system.

The Walthamstow Lighting Committee report that they have considered the report of the Superintendent with respect to the proposed installation of automatic controllers to the street gas-lamps in the Higham Hill portion of the district, and recommend that an order be placed with the Telephos Domestic and Street Lighting Company, Ltd., for fixing controllers to the lamps in question, subject to their agreeing to maintain the controllers for a period of six months, and if they are not satisfactory during this period to remove them at their own cost.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for April 21.]

Nos. 10,112—10,772.

Beard, G. F. H.—"Charging inclined or vertical gas-retorts, producers, &c." No. 10,503.
Bischof, B.—"Compressing gases by rotating liquid." No. 10,663.
Cambridge and Paul Instrument Company.—"Thermo-electric measurement of temperature." No. 10,539.
Craven, E. C.—"Production of mixed fuels consisting of solids and liquids." No. 10,532.
Delén, J. O.—"Electric gas-ignition devices." No. 10,542.
Dempster, R. & J.—See Beard. No. 10,503.
Dickens, C.—"Bunsen-nozzles for inverted incandescent gas-burners." No. 10,546.
Docking, A.—"Gas and air mixing and compressing apparatus." No. 10,376.
Fours et Procédés Mathy Soc. Anon.—"Surface-combustion gas-burners." No. 10,471.
Gould, F. J.—See Dickens. No. 10,546.
Griffin, C.—"Process of enrichment of producer gas generated within retort-settings or retorts." No. 10,496.
Hindle, W. H.—"Gas-boiler bath." No. 10,260.
Lucas, E. E —"Recuperators for gas-fired furnaces." No. 10,234.
Miller, A. J.—"Burner for gas heating." No. 10,123.
Ormandy, W. R.—See Craven. No. 10,532.
Pennell, R. H. L.—"Liquid meters." No. 10,560.
Sharp and Preston.—See Docking. No. 10,376.
Somers, E. E.—"Gas, &c., burners." No. 10,680.
Thacker, J.—"Gas-burners." No. 10,611.
Thomas, L. J.—See Thacker. No. 10,611.
Thompson, W. P.—See Fours. No. 10,471.
Trent, W. E.—"Treating carbonaceous material." No. 10,573.
Turner, J. B.—"Gas-saver." No. 10,128.
Urquhart, W. J.—"Apparatus for thermo-kinetically inducing flow of gas." No. 10,501.
Whiteside, W. H.—See Turner. No. 10,128.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words) 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

		ONE YEAR.		HALF-YEAR.		QUARTER.
United Kingdom	Advance Rate:	28/-	..	15/-	..	8/8
	Credit Rate:	32/-	..	16/-	..	9/6
Abroad (in the Postal Union) Payable in Advance		32/6	..	17/-	..	10/-

In payment of subscriptions for "Journals" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to Walter King, 11, Bolt Court, Fleet Street, London, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON
FOR SALE OUTRIGHT, OR ON LOAN.

SPENT OXIDE
PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO. LTD.,
Palmerston House,
Old Broad Street, London, E.C.2.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
Andrew Stephenson, Gresham House, Old Broad Street, London, E.C. "Volcanism, London."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham, and 45 & 47, Westminster Bridge Road, London, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"Braddock, Oldham," and "Metrique, Lamb, London."

BENZOL PLANTS FOR GAS-WORKS.
BAGLEY, MILLS, & CO., Ltd.,
92, Victoria Street, Westminster, S.W. 1, Invite inquiries from all Gas-Works making 75 million cubic feet and upwards per annum.

OXIDE OF IRON.
SPENT OXIDE BOUGHT.
BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C. 3.
Phone: Avenue 6680.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C. 3.
Phone: Avenue 6680.

"KLEENOFF," THE COOKER CLEANSER.
Tins for Sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C. 3.
Phone: Avenue 6680.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.

SPENSER CHAPMAN & MESSEL LTD., with which is amalgamated WM. PEARCE & SONS, LTD., Mark Lane, LONDON, E.C. Works—SILVERTOWN. Telegrams—"HYDROCHLORIC, FEN, LONDON." Telephone—1588 AVENUE (3 lines).

TULLY'S PATENT.

CARBURETTED HYDROGEN PLANT for 300 to 500 B.Th.U.

COMPLETE GASIFICATION OF COAL.

BALE AND HARDY, LTD., 89, VICTORIA STREET, LONDON, S.W. 1.

"FERROX." "FERROX." "FERROX."

A BRITISH Oxide Cheaper and Better than Bog Ore. 35 per cent. Water, 75 per cent. Ferric Hydrate.

For Sale outright or on Loan.

OXIDE LIMITED, Brentford, MIDDLESEX.

ALDER AND MACKAY, LTD.

(ESTABLISHED 1850.)

WET AND DRY METERS, SLOT AND ORDINARY.

STREET LAMPS AND AUTOMATIC CONTROLLERS.

EDINBURGH.

(See p. 224.)

SULPHATE OF AMMONIA

SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.

We Guarantee promptness with efficiency for Repairs.

JOSEPH TAYLOR AND CO., CHEMICAL PLANT ENGINEERS, BOLTON, LANCS.

Telegrams—"SATURATORS, BOLTON," Telephone 0848.

BRITISH LUX.

AN EXCELLENT PURIFYING MATERIAL.

Features:—

(a) Porosity equal to Best Bog Ore.
(b) Contains Ferric Hydrate in an active state, thus resembling "Lux."
(c) Prepared in good mechanical condition ready for Purifiers.

DANIEL MACFIE, 1, NORTH ST. ANDREW STREET, EDINBURGH.

SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.

See Illustrated Advertisement Feb. 17, p. 399.

MEWBURN, ELLIS, & CO.,

CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,

70 & 72, Chancery Lane, London, W.C. 2.

Telegrams: "Patent, London." Phone 243 Holborn.

And 3, 84, Nicholas Buildings, Newcastle-on-Tyne.

INVENTIONS PATENTED. TRADE MARKS REGISTERED.

Advice and Handbook free. 35 years' references. Gas Patents a Speciality. KING'S PATENT AGENCY, Ltd. (Director, B. T. King, A.I.M.E., British and U.S. Regd. Patent Agent), 165, QUEEN VICTORIA STREET, LONDON, E.C.4.

NO MORE COMPLAINTS.

DISTRIBUTE the New Instruction Folder. "HOW TO MANAGE THE GAS-COOKER."

Compiled by R. GAMBLE MARKS, Gas Stove Specialist, 54, Zetland Street, SOUTHPORT.

CORRESPONDENCE TUITION in GAS ENGINEERING

for City and Guilds Institute Exams. (Preliminary and Final). Successful Results. Low Fees.

PENNINGTONS ENGINEERING TUTORS, 254, Oxford Road, MANCHESTER.

BRITISH GAS PURIFYING MATERIAL.

ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON.
SPENT OXIDE BOUGHT.

BRITISH GAS PURIFYING MATERIALS CO., LTD.

(W. T. P. CUNNINGHAM, Chief Proprietor and Managing Director.)

13, ARCADIAN GARDENS, WOOD GREEN, LONDON, N. 22.

Telegrams: "Bripurimat, Wood, London."
'Phone: Palmers Green 608.

GEORGE WILSON

for

GAS-METERS, ORDINARIES, SLOTS, AND REPAIRS,

Foleshill Road, COVENTRY.

Telephone: 596. Telegrams: "GASMETER," and at

7/9 Grosvenor Street, C.on M., MANCHESTER.

Telephone: 3214 CITY. Telegrams: "GASMETER."

ENQUIRIES SOLICITED,

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA an SULPHUR RECOVERY PLANTS.

C. & W. WALKER, LIMITED, DONNINGTON, NEWPORT, SALOP.

HUTCHINSON BROTHERS, Ltd.

FALCON WORKS, BARNSLEY.

MANUFACTURERS OF

GAS METERS (Ordinary and Prepayment), "FALCON" INVERTED LAMPS for Street Lighting, INVERTED BURNERS and CONVERSION SET for Street Lamps.

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are

MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 60 years. Reference given to Gas Companies.

J. E. C. LORD, Ship Canal Tar Works,

Wesste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

NATIONAL ASSOCIATION OF TECHNICAL GAS OFFICIALS.

New Membership Forms and Particulars are now circulated.

If not received, please send Name and Address to

GENERAL SECRETARY,
Temple Courts,
55, Temple Row, BIRMINGHAM.

APPOINTMENT, &c., WANTED.

ADVERTISER, at present Engineer and MANAGER of 120 Million Works, DESIRES SIMILAR POSITION in 50 to 150 Million Works, or ASSISTANT in larger works. Life Experience in Gas Manufacture and Distribution.

Address No. 6894, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

ENGLISHMAN (28), good Organizer, seeks Position ASSISTANT or WORKS MANAGER. Wide Experience in Refractory Materials, Blast Furnace, and Chemical Trade. Not afraid of work. Excellent References.

Address No. 6887, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

EX-OFFICER desires Position as CHEMIST, ASSISTANT CHEMIST, or FOREMAN, at Home or Abroad. Good Training at Large Coke-Oven and Bye-Product Works in South Yorkshire. Good Testimonials.

Address No. 6893, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

APPOINTMENTS, &c., VACANT.

WHEN Filling Vacancies, please REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualifications being equal, has the FIRST CALL ON YOUR CONSIDERATION.

LEATHERHEAD GAS AND LIGHTING COMPANY.

THOROUGHLY Qualified Engineer and MANAGER Required for 120 Million Works. Must have had Successful Experience in Similar Position. Well up in Efficient and Economical Manufacture and Distribution of Gas, Treatment of Residuals, High Pressure Supply, and usual Duties.

Salary £400, House, Coal, and Gas.

Applications, marked "Gas Engineer," stating Age, Training, and Experience, with *copies* of not more than Three recent Testimonials, to be sent to "The Secretary, Gas Offices, Leatherhead," on or before Saturday, May 8.

Further Particulars can be obtained on Application to

JOHN YOUNG,
Secretary.

Gas Offices,
Leatherhead,
April 27, 1920.

PETERSFIELD AND SELSEY GAS COMPANY.

(PETERSFIELD WORKS.)

WORKING MANAGER.

WANTED—Working Manager. Must have thorough knowledge of Regenerator Settings. Wages £4 per Week, with House, Coal, and Gas.

Applications, with *copies* of Testimonials, to be sent to the SECRETARY, Gas Offices, Hylton Road, PETERSFIELD, on or before Monday, May 10.

WORKING Manager wanted for an 8 Million Works about 15 miles from London. Must have thorough Knowledge of Gas Plant, including Gas Engine, Exhauster, Regenerative Settings, and be a fully competent Fitter.

£200 per annum offered to a good Man, with Cottage, Gas, Coal, and Garden Free.

Reply, stating Age, Experience, when disengaged, with *copies* of recent Testimonials to No. 6892, care of MR. KING, 11, Bolt Court, Fleet Street, E. C. 4.

WANTED—Thoroughly Trained DISTRIBUTION SUPERINTENDENT for Gas-Works (West Riding of Yorkshire) making 200 Millions per Annum.

Apply, by letter, stating Age and Wages required, &c., to No. 6890, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.4.

WANTED—Thoroughly Trained ASSISTANT SUPERINTENDENT for a Works making about 1100 Millions.

Applications, stating Experience fully, with *copies* of Testimonials, to No. 6886, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

APPLICATIONS are invited for the Post as CHEMIST for Coke-Oven and Bye-Product Works—One Qualified to do Research Work and Control Laboratory. No Housing accommodation. Salary, £325 per Year.

Address No. 6888, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

DRAUGHTSMAN required in Westminster Office for Retort Plant and Structural Work.

Apply, by letter, stating Experience, Age, and Salary required, to No. 6889, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

WANTED—Competent Gas-Works FITTER having Thorough Knowledge of De Brouwer Stoking Machinery, Electric Motors, Engines, Pumps, &c., for 200 Million Works, West Riding of Yorkshire.

Apply, by letter, stating Age and Wages required, &c., to No. 6891, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

GAS-FITTER Wanted.—Must have Thorough Knowledge of All Branches of Modern Gas-Fitting. Wages £4 0s. 4d. for 47-Hour Week. Holidays with Pay.

Apply, giving full Particulars with References, to the ENGINEER AND MANAGER, Gas-Works, NELSON.